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Ms. Lori Wenkert  
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Subject: Phase 3 Interim Report No. 2 on the PSTA Research and Demonstration Project  
(C-E8624)

Dear Lori:

We are enclosing ten (10) copies of the referenced document along with an additional camera-ready copy that the District can use to make internal copies should the need arise. This report provides an interim summary of the data collected from the PSTA Field Scale Cells during the study period of August 2001 to April 2002. A more detailed data analysis will be presented in the Phase 3 final report.

Copies of the full document are being sent to the following interested parties: Frank Nearhoof and Taufiqal Aziz at the Florida Department of Environmental Protection, Nick Aumen at the National Park Service, Ron Jones at FIU (c/o Evelyn Gaiser), Bob Kadlec, and Bill Walker.

As always, should any questions arise regarding the enclosures, please feel free to call.

Sincerely,

CH2M HILL

Ellen Patterson  
Associate Scientist

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*P*eriphyton-Based Stormwater  
Treatment Area (PSTA) Research  
and Demonstration Project  
Phase 3 Interim Report No. 2  
(August 2001 - April 2002)

Prepared for



**South Florida Water Management District**

Prepared by

**CH2MHILL**

September 2002

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# Acronyms

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$\mu\text{g/L}$	micrograms per liter
$\mu\text{mhos/cm}$	micromhos per centimeter
AFDW	ash-free dry weight
ATT	Advanced Treatment Technology
$^{\circ}\text{C}$	degrees Celsius
cm	centimeter
cm/d	centimeters per day
CR	community respiration
DO	dissolved oxygen
DOP	dissolved organic phosphorus
DRP	dissolved reactive phosphorus
in/day	inches per day
EAA	Everglades Agricultural Area
EFA	Everglades Forever Act
ENR	Everglades Nutrient Removal
ET	evapotranspiration
FeCL	ferric chloride
ft	feet
g	gram
$\text{g/m}^2/\text{y}$	grams per square meter per year
GPP	gross primary productivity
HLR	hydraulic loading rate
L/kg	liters per kilogram
m/y	meters per year
$\text{m}^2/\text{d}$	square meter per day
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MJ	megajoules
MWI	Moving Water Industries
$\text{O}_2/\text{m}^2/\text{d}$	$\text{O}_2$ per square meter per day

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P	phosphorus
PACL	polyaluminum chloride
PAR	photosynthetically active radiation
POR	period of record
ppb	part(s) per billion
PSTA	periphyton-based stormwater treatment area
SFWMD	South Florida Water Management District
STA	stormwater treatment area
TDS	total dissolved solids
TLD	Team Land Development
TN	total nitrogen
TOC	total organic carbon
TP	total phosphorus
TPP	total particulate phosphorus
TSS	total suspended solids

# Executive Summary

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The South Florida Water Management District (District) is conducting research focused on determining the effectiveness and design criteria of potential advanced treatment technologies (ATTs) to support the reduction of phosphorus (P) loads in surface waters entering the Everglades (SFWMD, 2000). Periphyton-based stormwater treatment areas (PSTAs) are one of the ATTs being researched by the District for potential application downstream of the macrophyte-based stormwater treatment areas (STAs). Evaluations remain focused on PSTAs as post-STA treatment units to help achieve compliance with the ultimate total phosphorus (TP) criterion of 10 parts per billion (ppb).

A two-phased approach was originally adopted to investigate the PSTA concept. The project approach has been modified to include Phase 3, which includes a demonstration of PSTA viability, effectiveness, and sustainability at a larger, field scale. These three phases are highlighted below:

- **Phase 1** began in the spring of 1999 and ended in March 2000. Work included development of the work plan and experimental design, initial research in three experimental test cells (PSTA Test Cells) at the southern end of the former Everglades Nutrient Removal (ENR) project (now part of STA-1W), and construction of and research using 24 portable experimental mesocosms (Porta-PSTAs). Information collected during this project phase was summarized in the *Phase 1 Summary Report* (CH2M HILL, August 2000).
- **Phase 2** included the continued monitoring of the PSTA Test Cells and in Porta-PSTA mesocosms operated during Phase 1. Phase 2 research in the Porta-PSTAs concluded in early October 2000. Work in the PSTA Test Cells ended in April 2001. Supplemental mass balance (destructive) sampling of selected Porta-PSTA mesocosms was conducted in February 2001, with results reported in the *Porta-PSTA Mass Balance (Destructive) Report* (CH2M HILL, August 2001). In addition, the expanded PSTA operational database was used to further refine and calibrate the PSTA Forecast Model, and to develop design criteria for a full-scale PSTA system. The PSTA Forecast Model was applied to support projections of the long-term cost of implementing PSTAs to meet ultimate P reduction goals under the Everglades Forever Act (EFA). Information collected during this project phase was presented in the *Phase 1 and 2 Summary Report* (CH2M HILL, July 2002a).
- **Phase 3** includes operation and monitoring of four 5-acre Field-Scale PSTA Cells located immediately west of STA-2. This demonstration phase is testing various methods of substrate preparation (limerock cap, scrape-down, and existing peat-based soils), effects of cell configuration and flow velocity, and effects of groundwater exchanges (losses and gains). In addition, a study of soil pretreatment options and effectiveness will be conducted during Phase 3. Field-Scale Cell (FSC) construction was completed in early 2001, and monitoring began in late July 2001. The operations and monitoring schedule for the Field-Scale Demonstration Project has been extended through December 2002.

This report provides an interim summary of PSTA FSC data collected during the initial 9 months of Phase 3 (August 2001–April 2002). A more detailed analysis of PSTA Field-Scale data will be presented in the final Phase 3 report.

Between April 2000 and early 2001, four PSTA FSCs were constructed from onsite materials. These four cells are each approximately 20,000 square meters (m<sup>2</sup>) (5 acres). Three of the cells are rectangular at 61 m wide by 317 m long (200 feet [ft] by 1,040 ft), and one cell is sinuous with a length of 951 m (3,120 ft) and a width of 21 m (70 ft). Field-Scale Cells 1 and 2 (FSC-1 and FSC-2, respectively) have approximately 60 centimeters (cm) or 24 inches of limerock placed over the native peat soils. The relatively shallow peat soils were excavated and removed from FSC-3 to expose the underlying caprock. Native peat soils with no amendments or other pre-treatments comprise the floor of FSC-4.

Interim Phase 3 findings for the referenced period are summarized as follows:

- Total incoming solar radiation averaged 16.04 megajoules (MJ) per square meter per day (m<sup>2</sup>/day), and photosynthetically active radiation (PAR) averaged 22.68 mols per m<sup>2</sup>/d.
- The total rainfall was 89.2 cm (35.1 in), which is equal to approximately 0.33 centimeters per day (cm/d) (0.13 inches per day [in/d]), while evapotranspiration (ET) was 92.5 cm (36.4 in), or 0.33 cm/d (0.13 in/d). These data indicate that there was a relatively small net ET loss from the PSTA FSCs (-3.3 cm or 1.3 in) during this research period.
- Leakance was estimated by measuring the change in static water levels during periods of no inflow pumping. Based on these estimates, net leakance rates appear to have increased in some cells between the construction and operation periods. It appears that a significant fraction of the water pumped into these cells exits by infiltration to groundwater.
- Average inflow hydraulic loading rates (HLRs) estimated for this period for FSC-1 through FSC-4 were 7.5, 11.6, 5.3, and 7.2 cm/d, respectively. The average residuals (estimate for net groundwater exchanges) for FSC-1 through FSC-4 for this same period were 4.0, 5.9, -3.3, and 5.5 cm/d, respectively. These independent estimates of infiltration are comparable to those estimated during non-flow-through periods.
- Soil testing was conducted in the PSTA FSCs in February 2001 and April 2002. Results showed that percent moisture in the limerock cells averaged approximately 32 percent. TP averaged 100 milligrams per kilogram (mg/kg), with approximately 73 percent in the inorganic form. Of the inorganic P, approximately 91 percent was calcium-bound. Of the TP, approximately 67 percent was in the calcium-bound form, and 21 percent was in residual organic forms. The scrape-down cell had a slightly lower average TP of 103 mg/kg, with approximately 66 percent in the calcium-bound form and the remainder largely in the residual organic form. The organic peat soil in FSC-4 was different from the other three cells. The TP averaged 404 mg/kg, with approximately 94 mg/kg (23 percent) in labile forms. Approximately 233 mg/kg of TP (58 percent) was in moderately labile or residual organic forms.
- The average TP in the inflow was 21 micrograms per liter (µg/L) during this period with a range of measured concentrations from 8 to 64 µg/L. Of this TP, approximately 50 percent was in the dissolved form, 17 percent as dissolved reactive P (DRP), and 33 percent

as dissolved organic P (DOP). Outflow TP averaged 20, 15, 15, and 22  $\mu\text{g/L}$  in FSC-1, FSC-2, FSC-3, and FSC-4, respectively.

- Average TP in all wells was 14  $\mu\text{g/L}$ , with means in individual wells ranging from 12 to 19  $\mu\text{g/L}$ . The well on the FSC-4 berm exhibited the highest average concentration (19  $\mu\text{g/L}$ ). The lowest average concentration of 12  $\mu\text{g/L}$  was observed at the well near the inflow to FSC-1.
- Average periphyton dry weight biomass was highest in FSC-2 at 828 grams per square meter ( $\text{g/m}^2$ ) and lowest in FSC-4 at 48  $\text{g/m}^2$ . Average ash-free dry weight (AFDW) biomass in these cells ranged from 19 to 146  $\text{g/m}^2$ . Calcium made up a relatively small proportion of the ash weight (21 to 35 percent). Periphyton TP ranged from 0.03 to 0.24  $\text{g/m}^2$  (296 to 863  $\text{mg/kg}$ ) and was approximately 0.19 percent of the AFDW in FSC-1 and 0.17 percent in FSC-2, FSC-3, and FSC-4 periphyton.
- Algal biovolume was highest in FSC-2 and lowest in FSC-4. On a biovolume basis, blue-green algal species dominated FSC-1 periphyton, green algal species dominated FSC-2 periphyton, and diatoms dominated the algal flora in FSC-3 and FSC-4.
- A detailed periphyton P fractionation analyses showed that average TP ranged from 143 to 155  $\text{mg/kg}$ , with approximately 55 percent in the organic form. Of this organic TP, approximately 29 percent was recalcitrant.
- Emergent macrophyte populations are being controlled by herbicide application and hand removal. Dominant macrophyte species included the macroalga *Chara*, spikerush (*Eleocharis cellulosa*), and narrow-leaf cattail (*Typha latifolia*). Average above-ground, dry-weight macrophyte biomass ranged from a low of 28.8  $\text{g/m}^2$  in FSC-3 to a high of 246  $\text{g/m}^2$  in FSC-1.
- Estimated average gross primary productivity (GPP) ranged from 1.2  $\text{g of O}_2$  per square meter per day ( $\text{O}_2/\text{m}^2/\text{d}$ ) in FSC-3 to 3.6  $\text{g O}_2/\text{m}^2/\text{d}$  in FSC-2. Community respiration (CR) ranged from 1.3  $\text{g of O}_2/\text{m}^2/\text{d}$  in FSC-3 to 3.6  $\text{g of O}_2/\text{m}^2/\text{d}$  in FSC-2. The average ratio between GPP and CR in these cells was equal to 1 in FSC-1, slightly higher than 1 in FSC-2, and less than 1 in FSC-3 and FSC-4. There was no net productivity estimated for FSC-1, a very small amount of net productivity estimated for FSC-2, and a negative net production estimated in FSC-3 and FSC-4.

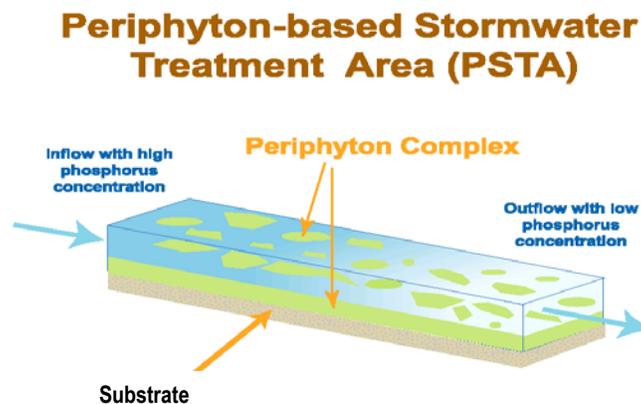
# Project Background

## 1.1 Introduction

The South Florida Water Management District (District) is conducting research focused on determining the effectiveness and design criteria of potential advanced treatment technologies (ATTs) to support the reduction of phosphorus (P) loads in surface waters entering the remaining Everglades (SFWMD, 2000). Particular focus is being placed on the treatment of surface waters from the Everglades Agricultural Area (EAA) as well as Lake Okeechobee water that is diverted through the primary canal system to the Lower East Coast of Florida.

Periphyton-based stormwater treatment areas (PSTAs) are one of the ATTs being researched by the District for potential application downstream of the macrophyte-based stormwater treatment areas (STAs). Evaluations remain focused on PSTAs as post-STA treatment units intended to help achieve compliance with the anticipated ultimate total phosphorus (TP) criterion of 10 parts per billion (ppb).

In concept, the periphyton complex is hypothesized as being capable of extracting available P in the water and incorporation of that P into the biomass of the periphyton mat. Settling of detrital matter contributes to the long-term P storage. Additionally, because of the high primary productivity of these periphyton systems, water quality conditions favor P precipitation and binding into the newly formed sediments. The result is a water outflow with much of the available P scavenged and retained in the system biomass and sediments. These concepts are depicted in Exhibit 1-1.



### EXHIBIT 1-1

Schematic Diagram of the Periphyton Stormwater Treatment Area (PSTA) Concept

Prior to initiation of the District's PSTA project in July 1998, detailed research to evaluate PSTA feasibility had not been performed. The key study objectives, therefore, were to

research and demonstrate (to the extent possible within the contract period) PSTA viability, effectiveness, and sustainability at several scales of application. The following specific questions were to be addressed:

- Viability: Can periphyton-dominated ecosystems for P control be established?
- Effectiveness: Can P removal and retention be achieved?
- Sustainability: Can PSTA viability and effectiveness be maintained for long-term periods?

Viability was assessed by documenting how long it took for the development of periphyton-dominated plant communities in the PSTA mesocosms, and whether they could be maintained for reasonable periods of time. Effectiveness as a water quality treatment approach was evaluated based on the ability of the PSTA test systems to achieve low TP outflow concentrations. The TP removal rate constant, a metric for P removal efficiency, was quantified for the various PSTA mesocosm conditions tested during the study. Because sustainability issues would not be fully addressable within the anticipated 3-year study period, this question was evaluated through development and application of a performance forecast model based on the empirical data generated by the field studies.

A two-phased approach was originally adopted to investigate the PSTA concept: an Experimental Phase (Phase 1) and a Validation/Optimization Phase (Phase 2). The project approach has been modified to include Phase 3, which includes a demonstration of PSTA viability, effectiveness, and sustainability at a larger, field-scale. The types of activities that are included in each phase are described as follows:

- Phase 1 included development of the work plan and experimental design, initial research in three experimental test cells (PSTA Test Cells) located at the southern end of the Everglades Nutrient Removal (ENR) project (see SFWMD 2000 for location of sites), and construction and startup/monitoring of research using 24 portable experimental mesocosms (Porta-PSTAs). The Phase 1 experimental studies provided critically needed information for addressing basic issues associated with PSTA viability and treatment performance effectiveness. Development of a preliminary forecast model and preliminary model calibration were also completed.
- Phase 2 included continuing research in the ENR PSTA Test Cells and in the Porta-PSTAs, and design and observations during the District's construction of the field-scale demonstration PSTAs immediately west of STA-2. During Phase 2, the expanded PSTA operational database was used to further refine and calibrate the performance forecast model, and develop design criteria for a full-scale PSTA system. The forecast model was applied to support projections of the long-term cost of implementing PSTAs to meet ultimate P reduction goals under the Everglades Forever Act (EFA).
- Phase 3 includes operation and monitoring of four 5-acre Field-Scale PSTA Cells located immediately west of STA-2. This demonstration phase is developing pilot-scale treatment system performance data related to various methods of substrate preparation (limerock fill, scrape-down, and existing peat-based soils), effects of cell configuration and flow velocity, effects of groundwater exchanges, and soil pretreatment options and effectiveness.

In the aggregate, the PSTA Research and Demonstration Project is designed to develop defensible conclusions related to specific hypotheses that are relevant to key research questions and design issues described in the *PSTA Research Plan* (CH2M HILL, 2001). This interim report provides a summary of the PSTA findings during the Phase 3 operational period of August 2001 to April 2002.

## 1.2 Experimental Design

This section provides some key information related to the experimental design used in Phase 3 of the PSTA project. Exhibit 1-2 provides a summary of the Field-Scale Cell (FSC) design criteria and treatments during Phase 3. A more detailed description of the Field-Scale PSTA demonstration site is provided below.

### 1.2.1 Field-Scale Design Criteria

Exhibit 1-3 schematically illustrates the PSTA Field-Scale Demonstration Facility layout. Four PSTA Cells were constructed between April 2000 and early 2001 from onsite materials. These four cells are each approximately 20,000 square meters (m<sup>2</sup>) (5 acres). Three of the cells are rectangular at 61 m wide by 317 m long (200 by 1,040 feet [ft]), and one cell is sinuous with a length of 951 m (3,120 ft) and a width of 21 m (70 ft). FSC-1 and FSC-2 have approximately 60 centimeters (cm) or 24 inches of limerock placed over the native peat soils. The relatively shallow peat soils were excavated and removed from FSC-3 to expose the underlying caprock. Native peat soils with no amendments or other pre-treatments comprise the floor of FSC-4. Field-Scale construction activities and other key dates are summarized in Appendix A.

Influent water to this facility can be conveyed from two sources: the western STA-2 seepage control canal or Cell 3 of STA-2. These water sources can be used independently or by blending. Influent canal water is pumped through inlet manifolds into the four PSTA Cells using diesel pumps. The inlet flow rate is measured with a clamp-on ultrasonic meter on each inlet manifold. Water flows by gravity from the inlet deep zones to the outlet deep zones, which distribute and collect these flows. Water flows out of each cell through a single outlet weir box equipped with an Agridrain water level control structure, which contains 60-cm-wide removable stoplogs. The top stoplog acts as a horizontal overflow weir controlling the water level in the cell and, with a water level recorder, is used for outflow quantification. Scaffold-type "boardwalks" are installed across the width of each cell at the center point to allow access for internal sampling. A series of groundwater sampling wells are arranged within and around the Field-Scale PSTAs to allow monitoring of groundwater TP gains and losses. Low densities of spikerush were planted in bands across the width of each cell with the objective of helping to prevent periphyton mat wash-out toward the outflow structure. Periphyton colonization was by natural recruitment. Construction of the PSTA Field-Scale Demonstration Facility was substantially completed during the first quarter of 2001, and routine operation and monitoring began in late July 2001. Start up of formal monitoring was delayed by the drought of 2001 and mechanical problems with the inflow pumps. The period-of-record (POR) covered in this interim report is August 2001 through April 2002.

**EXHIBIT 1-2**

Experimental Treatments and Design Criteria for PSTA Field-Scale Demonstration Cells

Design Parameter	PSTA Treatment			
	FSC-1	FSC-2	FSC-3	FSC-4
No. Cells	1	1	1	1
Flow (m <sup>3</sup> /d)				
Average	1250	1250	1250	1250
Maximum	2500	2500	2500	2500
Minimum	0	0	0	0
Cell Length (m)	315	945	315	315
Cell Width (m)	66	22	66	66
Aspect Ratio	5	43	5	5
Horizontal Cell Area (m <sup>2</sup> )	20790	20790	20790	20790
Operational Water Depth (m)				
Average	0.30	0.30	0.30	0.30
Maximum	0.60	0.60	0.60	0.60
Minimum	0.00	0.00	0.00	0.00
Operational Water Volume (m <sup>3</sup> )				
Average	6237	6237	6237	6237
Maximum	12474	12474	12474	12474
Minimum	0	0	0	0
Nominal Hydraulic Residence Time (d)				
@ average flow and depth	5.0	5.0	5.0	5.0
@ maximum flow and minimum depth	0.0	0.0	0.0	0.0
@ minimum flow and maximum depth	INF	INF	INF	INF
Hydraulic Loading Rate (cm/d)				
@ average flow and depth	6.0	6.0	6.0	6.0
@ maximum flow	12.0	12.0	12.0	12.0
@ minimum flow	0.0	0.0	0.0	0.0
Nominal Linear Velocity (m/d)				
@ average flow and depth	63	189	63	63
Substrate	LR-PE	LR-PE	CR	PE
Liner (Yes/No)	No	No	No	No
Deep Zones				
Number per Cell	2	4	2	2
Depth Below Floor Elevation (m)	1	1	1	1
Plant Species (Yes/No)				
Periphyton	Yes	Yes	Yes	Yes
Macrophytes	Yes	Yes	Yes	Yes
Design TP Influent Quality (µg/L)				
Average	25	25	25	25
Maximum	40	40	40	40
Minimum	15	15	15	15
Design TP Mass Loading (g/m <sup>2</sup> /y)				
Average	0.55	0.55	0.55	0.55
Maximum	0.88	0.88	0.88	0.88
Minimum	0.33	0.33	0.33	0.33

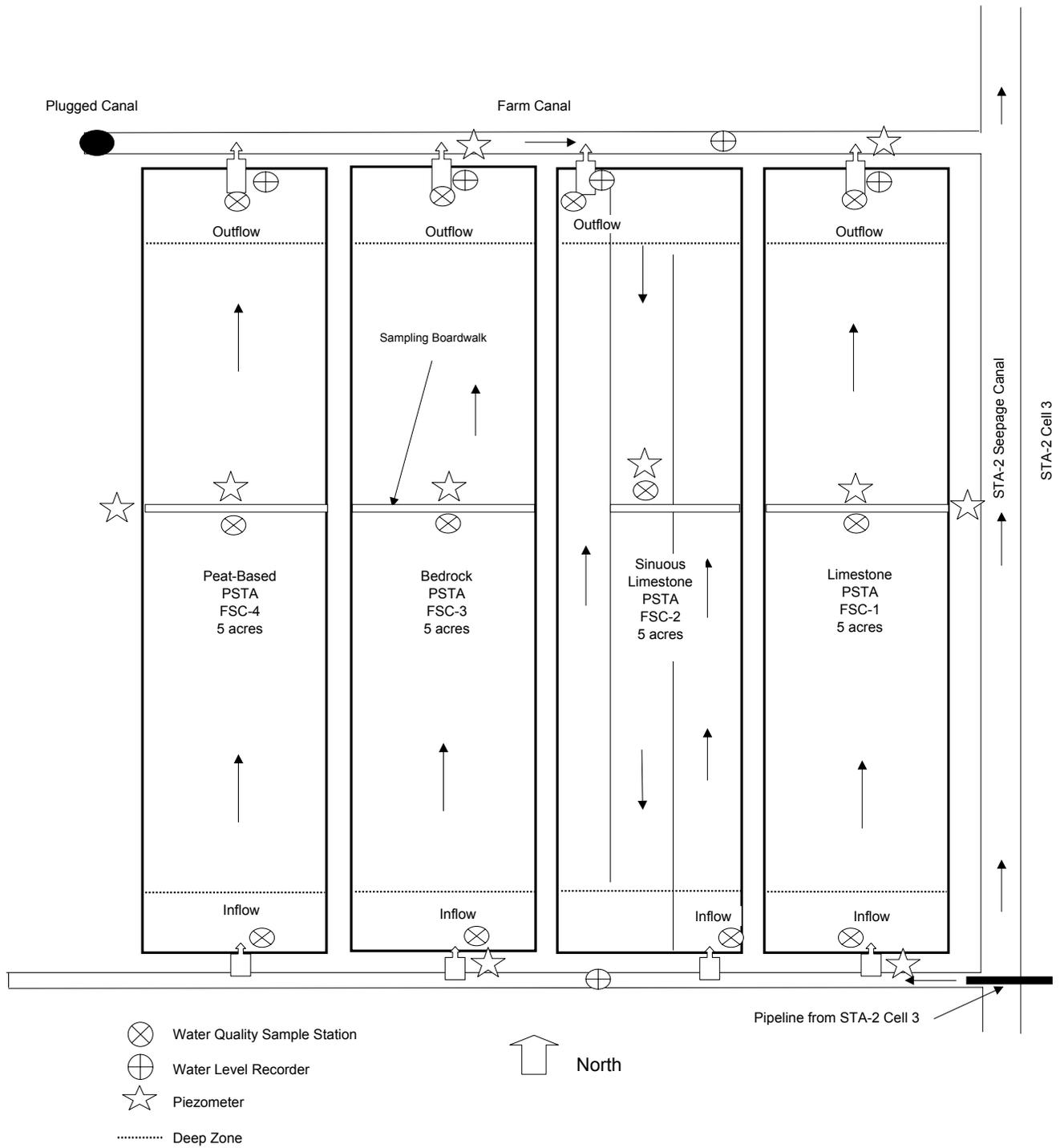
Notes:

PE = peat

LR-PE = limerock fill over peat

CR = limestone caprock

INF = infinite



**EXHIBIT 1-3**  
Schematic of Field-Scale Cells Showing Sampling Locations

## **1.2.2 Sampling Plan**

Exhibit 1-4 summarizes the analytical sampling plan for the Field-Scale PSTA Demonstration Project. Water stage and flows in the cells are continuously monitored. Field measurements are collected weekly, as are inflow and outflow P forms. Other important water quality parameters, such as nitrogen and calcium, are monitored monthly. Biological sampling for periphyton and macrophyte biomass and P storages is conducted monthly or quarterly. Sediments were sampled at the start and mid-point of Phase 3, and will be sampled again at the end of the monitoring period. The operations and monitoring schedule for the Field-Scale Demonstration Project has been extended through December 2002. The scope of these efforts is discussed further in Section 7.

## **1.3 Document Organization**

This interim report summarizing PSTA findings during the Phase 3 operational period of August 2001 to April 2002 consists of the remaining sections:

Section 2: Environmental Forcing Functions

Section 3: Site Hydrology and Water Balance

Section 4: Antecedent Soils

Section 5: Water Quality

Section 6: Biological Community

Section 7: Continuing Operations Plan

Section 8: Works Cited

Appendix A: Key Dates Summary

Appendix B: Weekly Water Balance, Water Quality, and Metabolism Summaries

Appendix C: Trend Charts

Appendix D: Detailed Algal Species Counts and Biovolumes

**EXHIBIT 1-4**  
**Sampling Plan for PSTA Field-Scale Demonstration Facility, FSC-1 through FSC-4**

**Sampling Locations and Frequency**

Parameter	Piezometers	Inflow Canal	Inflow	1/2	Outflow	Outflow Canal
<b>Field Meter Readings</b>						
Flow	NA	NA	Pump	NA	calc	NA
Water Stage	W	C(I)	W	C(I)	W	C(I)
Water temperature	W	W	W	C(I)	W	NA
Dissolved oxygen	NA	W	W	C(I)	W	NA
pH	W	W	W	C(I)	W	NA
Conductivity	W	W	W	C(I)	W	NA
Total Dissolved Solids (note a)	W	W	W	C(I)	W	NA
Turbidity (note a)	W	W	W	C(I)	W	NA
PAR	NA	NA	NA	M	NA	NA
<b>Water Quality Analyses</b>						
Phosphorus (P) Series						
Total P	M	NS	W	M	W	NS
Dissolved Reactive P	NS	NS	W	M	W	NS
Total Dissolved P	NS	NS	W	M	W	NS
Nitrogen (N) Series						
Total N	NS	NS	M	Q	M	NS
Ammonia N	NS	NS	M	Q	M	NS
Total Kjeldahl N	NS	NS	M	Q	M	NS
Nitrate+nitrite N	NS	NS	M	Q	M	NS
Total suspended solids	NS	NS	M	Q	M	NS
Total organic carbon	NS	NS	M	Q	M	NS
Calcium	NS	NS	M	Q	M	NS
Alkalinity	NS	NS	M	Q	M	NS
Chlorides	M	NS	M	Q	M	NS
<b>Biological Analyses</b>						
Periphyton Cover	NS	NS	NS	M	NS	NS
Macrophyte Cover	NS	NS	NS	M	NS	NS
Periphyton Dominant Species	NS	NS	NS	Q	NS	NS
Biomass (AFDW)	NS	NS	NS	Q	NS	NS
Calcium	NS	NS	NS	Q	NS	NS
Cholorophyll a , b , c , phaeophytin	NS	NS	NS	Q	NS	NS
Phosphorus (P) Series						
Total P	NS	NS	NS	Q	NS	NS
Total Inorganic P	NS	NS	NS	Q	NS	NS
Non-reactive P	NS	NS	NS	Q	NS	NS
Total Kjeldahl N	NS	NS	NS	Q	NS	NS
Accretion (Net Organic/Inorganic)	NS	NS	NS	Q	NS	NS
<b>Sediments (Start and End)</b>						
Phosphorus (P) Series						
Total P	NS	NS	NS	S/E	NS	NS
Total Inorganic P	NS	NS	NS	S/E	NS	NS
Non-reactive P	NS	NS	NS	S/E	NS	NS
Phosphorus Sorption/Desorption	NS	NS	NS	S/E	NS	NS
Total kjeldahl N	NS	NS	NS	S/E	NS	NS
Total organic carbon	NS	NS	NS	S/E	NS	NS
Bulk density	NS	NS	NS	S/E	NS	NS
Solids (percent)	NS	NS	NS	S/E	NS	NS
<b>System-Level Parameters</b>						
Gross primary productivity	NS	NS		C(I)		NS
Net primary productivity	NS	NS		C(I)		NS
Community respiration	NS	NS		C(I)		NS

**Notes:**

note a = presumes Hydrolab sensor available  
W = weekly  
M = monthly  
Q = quarterly  
(D) = sampled by District  
C(I) = continuous with instrument

NS = not sampled  
S/E - start and end of study phase  
NA = not applicable  
Assumes number of piezometers = 12  
Assumes number of mesocosms = 4

# Environmental Forcing Functions

## 2.1 Introduction

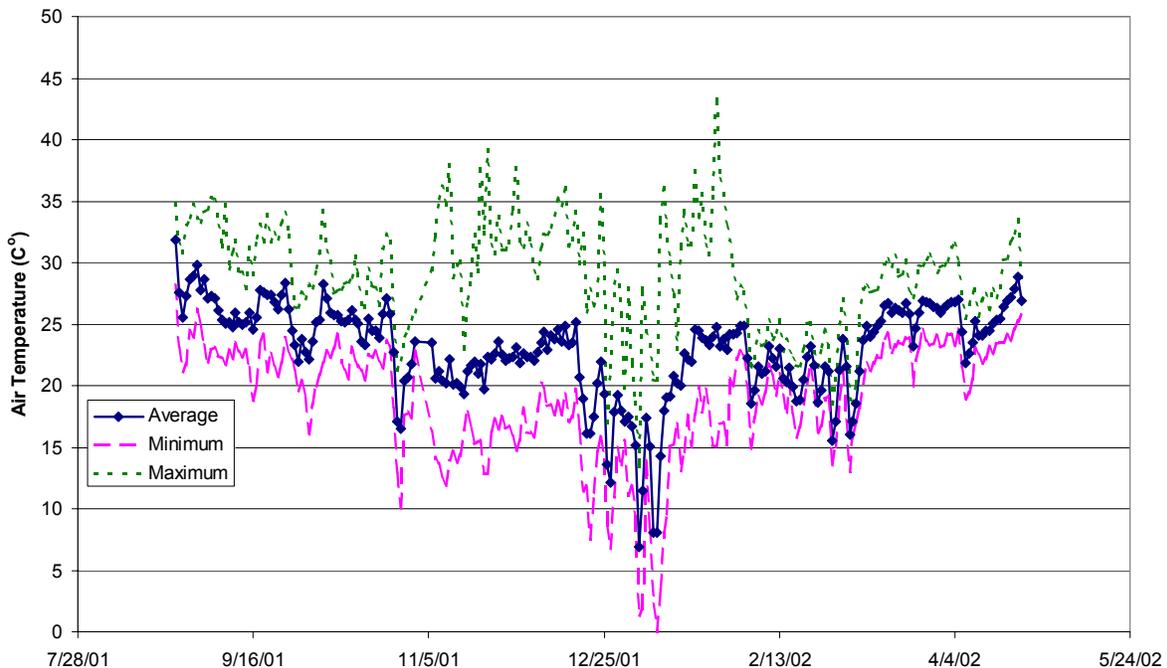
External environmental forcing functions that affect the growth and performance of the Field-Scale PSTAs include:

- Temperature
- Solar inputs (measured as total insolation and photosynthetically active radiation [PAR])
- Rain inputs
- Evapotranspiration (ET) outputs
- Inflows and associated P concentrations (described in Section 3)

A record of each of the first four of these forcing functions for the Phase 3 POR is presented below.

## 2.2 Temperature

Air temperature affects the rates of all chemical and biological reactions. Exhibit 2-1 summarizes the daily mean, maximum, and minimum air temperatures recorded at the Field-Scale site during this operational period.

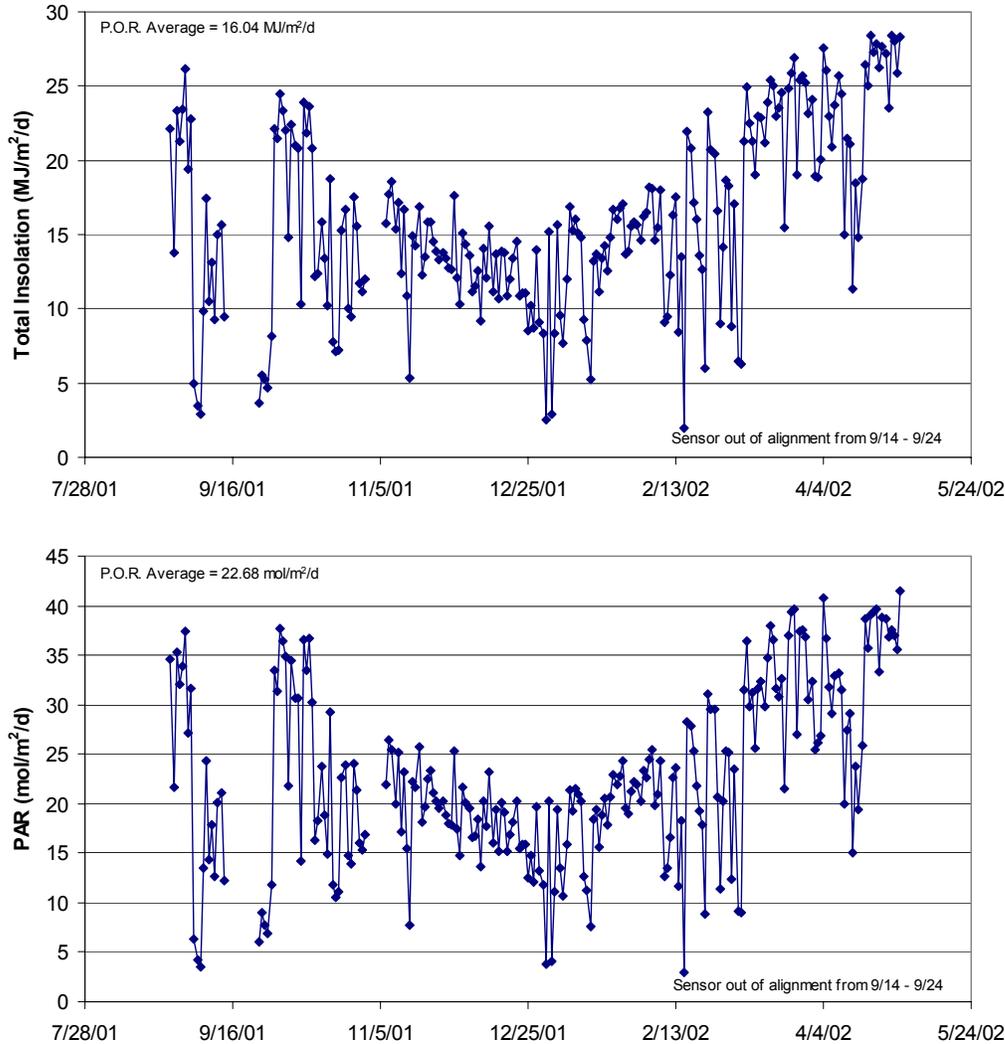


**EXHIBIT 2-1**

Average Daily Air Temperature Data from the Field-Scale PSTA Project Site

## 2.3 Solar Inputs

Exhibit 2-2 summarizes the total insolation and PAR received at the project site during the Phase 3 POR. During this period, total insolation averaged 16.04 megajoules (MJ) per m<sup>2</sup>/day (d), and PAR averaged 22.68 mols per m<sup>2</sup>/d.

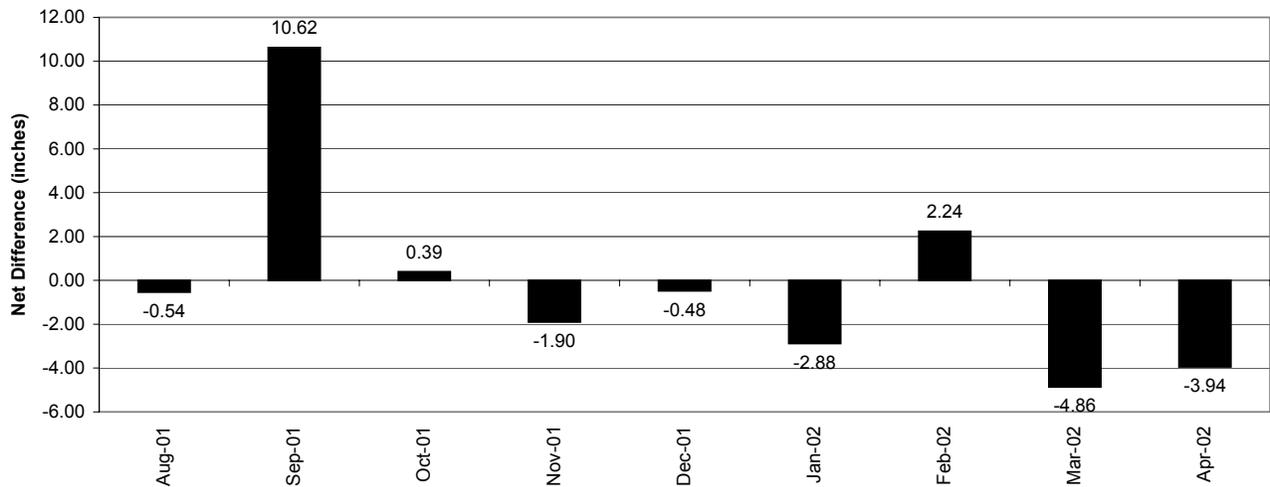
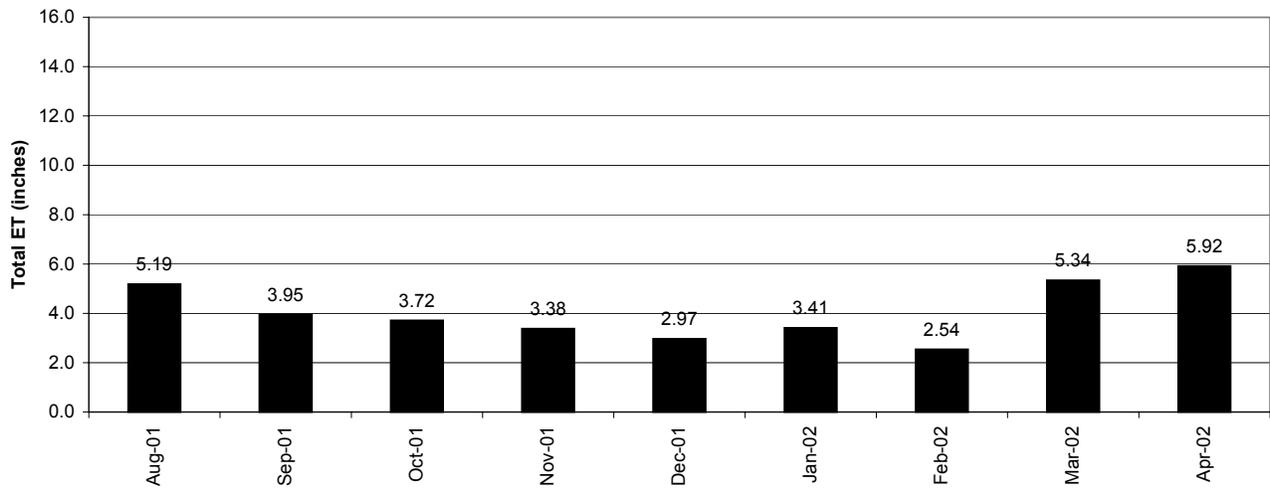
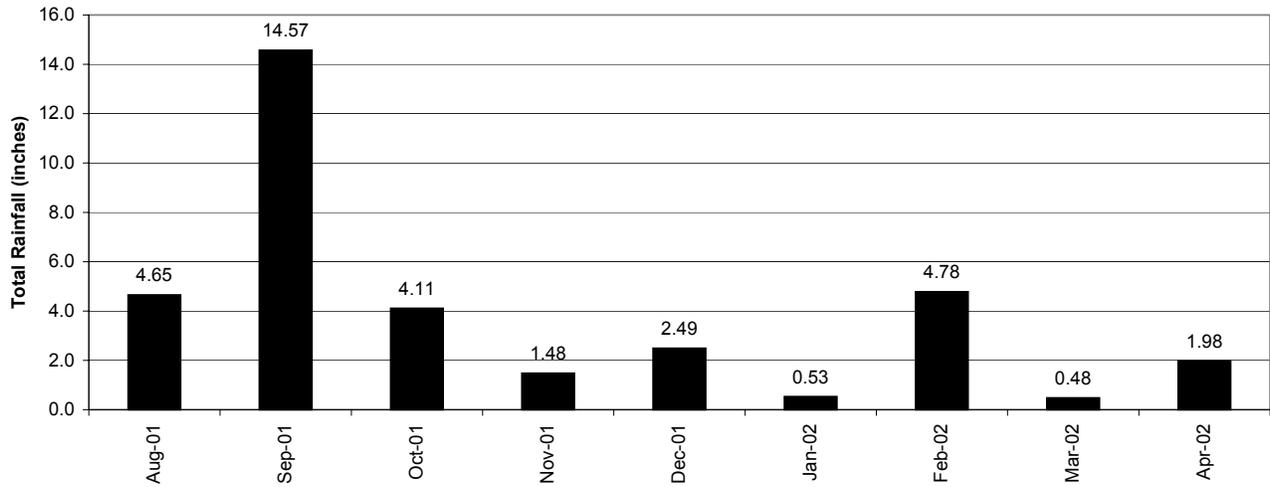


### EXHIBIT 2-2

Total Solar Radiation and Photosynthetically Active Radiation Measured at the Field-Scale PSTA Project Site

## 2.4 Precipitation and Evapotranspiration

Exhibit 2-3 compares the measured rainfall and estimated ET and their net difference during this POR. The total rainfall for the August 2001 through April 2002 period was 89.2 cm (35.1 in), which is equal to approximately 0.33 cm/d (0.13 in/d), while ET was 92.5 cm (36.4 in), or 0.33 cm/d (0.13 in/d). These data indicate that there was a relatively small net ET loss from the PSTA Field-Scale Cells (-3.3 cm or -1.3 in) during this research period.



**EXHIBIT 2-3**  
 Monthly Rainfall and Evapotranspiration Data at the District's Rainfall (S7-R) and ET (STA1W) Stations

# Site Hydrology and Water Balance

---

## 3.1 Introduction

One key research issue in the Field-Scale PSTA project is related to quantifying the effects of leakance to and from the groundwater. Previous work conducted in the Porta-PSTAs and PSTA Test Cells did not have groundwater exchanges because the research was conducted in fiberglass tanks and lined constructed wetland cells. In contrast, the Field-Scale PSTA Cells are unlined constructed wetlands that clearly will be affected by groundwater conditions in a manner similar to that for the existing STAs or for prospective full-scale PSTA systems. While inflows are intended to be relatively constant, they have varied considerably because of pump problems and continuing construction and operational needs. Other water gains and losses are also irregular. Rainfall is intermittent; ET follows a daily rhythm affected by time of day, cloud cover, humidity, wind, and temperature; and groundwater seepage responds to water depth inside and outside the cells as well as to changing soil conditions. Outflows from the cells are equal to the sum of these water inputs and outputs. Monitoring efforts to-date have focused on quantifying the magnitude of these various water flows. A preliminary water balance and estimates of leakance are provided below for the PSTA FSCs.

Components of the water balance that are directly measured or estimated onsite include surface water inflows and outflows, and rainfall. Inflows were not monitored until November 8, 2001, when ultrasonic flow meters were installed on all four inflow manifolds. Prior to November 8, inflows were estimated based on water level records, which indicated when the pumps were running and the average pumping rate from the November period when inflows were directly measured. Some inflow measurement problems continue to arise because of low water levels in the inflow canal. Inflow numbers were estimated for a few limited periods when water level records indicated that the inflow meters were not accurately recording flows.

Outflows are estimated through use of a recording water level sensor and a weir equation for flow over a 24-inch horizontal weir (Agri-drain stoplog) with end constrictions. ET is estimated from a District station located in STA-1W. Storage is estimated from beginning and ending water level records in the cells. Groundwater exchanges are calculated by difference and compared to the results of cell-wide leakance estimates.

## 3.2 Water Budget

Exhibit 3-1 provides estimated monthly and POR water balances for the Field-Scale PSTA Cells. Weekly estimates are provided in Appendix B-1. All surface water inflows prior to November 8, 2001, are estimated values. Average inflow hydraulic loading rates (HLRs) estimated for this period for FSC-1 through FSC-4 were 7.5, 11.6, 5.3, and 7.2 cm/d, respectively. The residual term in Exhibit 3-1 is an independent estimate of net groundwater exchanges.

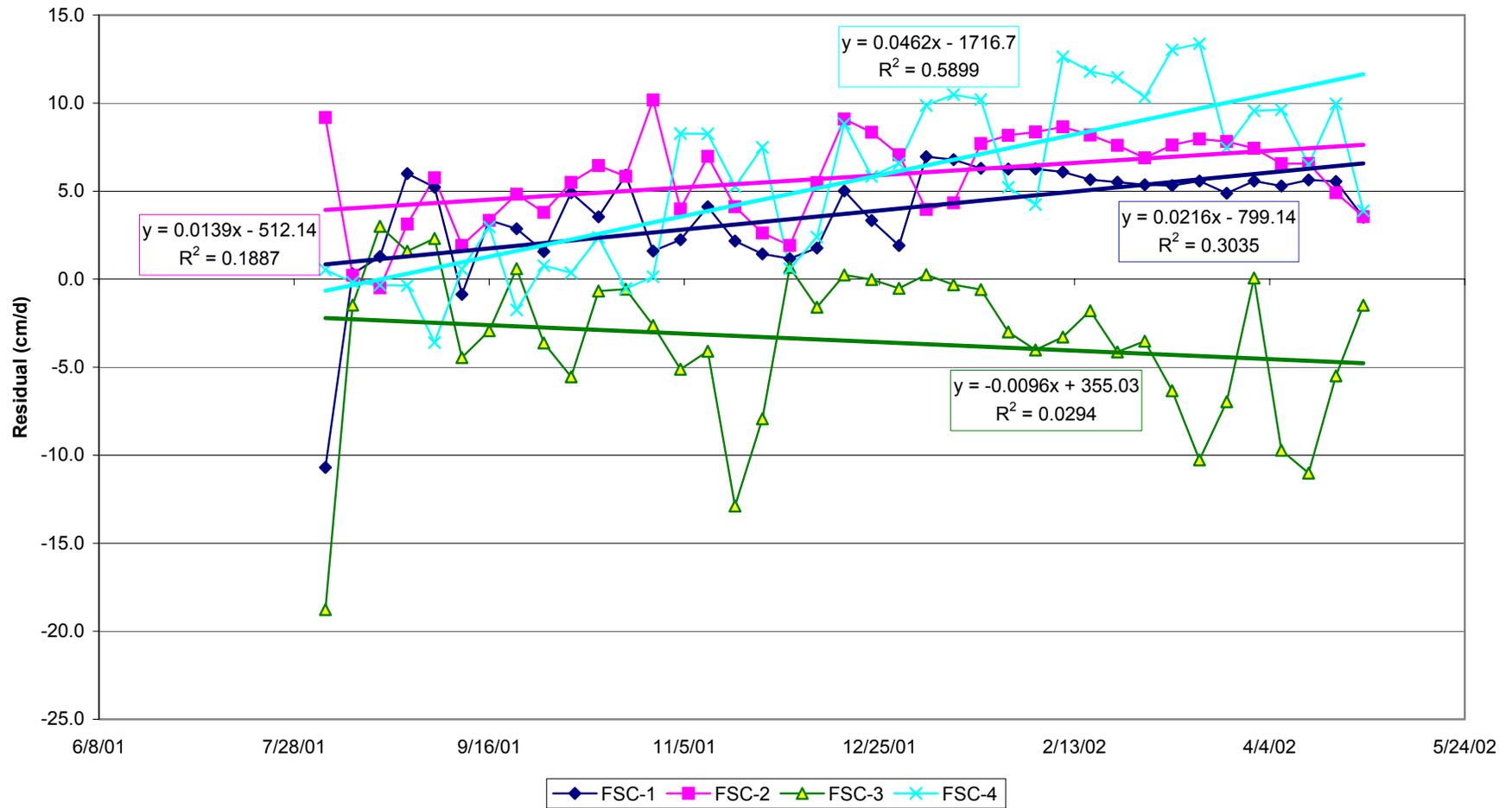
**EXHIBIT 3-1**

Estimated Water Balance for the Field-Scale PSTA Cells, August 2001 - April 2002

Cell	Freq	Time Period	Rainfall		ET		Inflow		Outflow		Chng Storage (m <sup>3</sup> )	Residual		
			(cm)	(m <sup>3</sup> )	(cm)	(m <sup>3</sup> )	(m <sup>3</sup> /d)	(m <sup>3</sup> )	(m <sup>3</sup> /d)	(m <sup>3</sup> )		(% of Inflow)	(cm/d)	
FSC-1	Monthly	Aug-01	11.8	2,390	13.2	2,666	1,469	45,540	1,406	43,590	-1,732	3,406	7.1	0.5
	Monthly	Sep-01	37.0	7,488	10.0	2,031	506	15,180	204	6,132	-2,734	17,240	76.1	2.8
	Monthly	Oct-01	10.4	2,112	9.4	1,910	1,387	43,010	634	19,652	-786	24,347	54.0	3.9
	Monthly	Nov-01	3.8	761	8.6	1,735	554	16,615	101	3,040	-1,126	13,727	79.0	2.3
	Monthly	Dec-01	6.3	1,280	7.5	1,524	657	20,378	57	1,757	1,388	16,989	78.4	2.7
	Monthly	Jan-02	1.3	272	8.7	1,753	2,238	69,365	894	27,703	3,320	36,862	52.9	5.9
	Monthly	Feb-02	12.1	2,457	6.5	1,305	2,651	74,237	1,465	41,030	565	33,794	44.1	6.0
	Monthly	Mar-02	1.2	247	13.6	2,746	2,223	68,916	1,080	33,486	-360	33,291	48.1	5.3
Monthly	Apr-02	5.0	1,018	15.0	3,044	1,832	54,968	759	22,758	-1,891	32,075	57.3	5.3	
FSC-2	Monthly	Aug-01	11.8	2,390	13.2	2,666	1,088	33,730	55	1,693	1,208	30,553	84.6	4.9
	Monthly	Sep-01	37.0	7,488	10.0	2,031	1,687	50,595	957	28,700	1,753	25,600	44.1	4.2
	Monthly	Oct-01	10.4	2,112	9.4	1,910	3,373	104,563	2,162	67,025	-401	38,140	35.8	6.1
	Monthly	Nov-01	3.8	761	8.6	1,735	1,651	49,523	1,047	31,412	-5,032	22,168	44.1	3.7
	Monthly	Dec-01	6.3	1,280	7.5	1,524	2,357	73,062	889	27,566	5,494	39,757	53.5	6.3
	Monthly	Jan-02	1.3	272	8.7	1,753	2,188	67,818	975	30,240	-827	36,926	54.2	5.9
	Monthly	Feb-02	12.1	2,457	6.5	1,305	2,923	81,844	1,275	35,688	206	47,101	55.9	8.3
	Monthly	Mar-02	1.2	247	13.6	2,746	3,041	94,257	1,436	44,521	164	47,072	49.8	7.5
Monthly	Apr-02	5.0	1,018	15.0	3,044	2,763	82,894	1,535	46,044	-1,753	36,576	43.6	6.0	
FSC-3	Monthly	Aug-01	11.8	2,390	13.2	2,666	1,913	59,299	2,465	76,408	-2,215	-15,170	-24.6	-2.4
	Monthly	Sep-01	37.0	7,488	10.0	2,031	1,769	53,057	2,120	63,596	1,367	-6,449	-10.7	-1.1
	Monthly	Oct-01	10.4	2,112	9.4	1,910	2,215	68,662	2,716	84,186	-41	-15,281	-21.6	-2.4
	Monthly	Nov-01	3.8	761	8.6	1,735	943	28,288	2,796	83,885	-2,539	-54,032	-186.0	-8.9
	Monthly	Dec-01	6.3	1,280	7.5	1,524	400	12,414	404	12,539	1,187	-1,557	-11.4	-0.2
	Monthly	Jan-02	1.3	272	8.7	1,753	374	11,582	449	13,907	57	-3,862	-32.6	-0.6
	Monthly	Feb-02	12.1	2,457	6.5	1,305	1,224	34,281	1,856	51,961	483	-17,012	-46.3	-3.0
	Monthly	Mar-02	1.2	247	13.6	2,746	421	13,036	1,715	53,179	-1,568	-41,075	-309.2	-6.5
Monthly	Apr-02	5.0	1,018	15.0	3,044	441	13,229	1,636	49,072	545	-38,414	-269.6	-6.3	
FSC-4	Monthly	Aug-01	11.8	2,390	13.2	2,666	0	0	0	0	-1,638	1,362	57.0	0.2
	Monthly	Sep-01	37.0	7,488	10.0	2,031	0	0	28	850	7,110	-2,502	-33.4	-0.4
	Monthly	Oct-01	10.4	2,112	9.4	1,910	0	0	0	0	-3,037	3,239	153.4	0.5
	Monthly	Nov-01	3.8	761	8.6	1,735	1,450	43,513	0	0	-2,948	45,486	102.7	7.5
	Monthly	Dec-01	6.3	1,280	7.5	1,524	2,178	67,526	992	30,744	8,884	27,654	40.2	4.4
	Monthly	Jan-02	1.3	272	8.7	1,753	2,620	81,220	857	26,579	-4,163	57,323	70.3	9.1
	Monthly	Feb-02	12.1	2,457	6.5	1,305	2,483	69,529	512	14,335	2,678	53,669	74.6	9.5
	Monthly	Mar-02	1.2	247	13.6	2,746	2,488	77,124	172	5,319	242	69,064	89.3	11.0
Monthly	Apr-02	5.0	1,018	15.0	3,044	2,053	61,576	515	15,447	-6,620	50,722	81.0	8.4	
FSC-1	POR	Aug 01-Apr 02	89.1	18,024	92.5	18,714	1,520	413,453	726	197,520	-4,065	219,309	50.8	4.0
FSC-2	POR	Aug 01-Apr 02	89.1	18,024	92.5	18,714	2,356	640,867	1,168	317,774	180	322,223	48.9	5.9
FSC-3	POR	Aug 01-Apr 02	89.1	18,024	92.5	18,714	1,080	293,727	1,762	479,233	-3,382	-182,814	-58.6	-3.3
FSC-4	POR	Aug 01-Apr 02	89.1	18,024	92.5	18,714	1,467	399,140	353	96,100	383	301,967	72.4	5.5

The average residuals for FSC-1 through FSC-4 for this same period were 4.0, 5.9, -3.3, and 5.5 cm/d, respectively.

Exhibit 3-2 illustrates the time series for these water budget residuals. These plots indicate that leakage may be increasing with time, and not decreasing as previously surmised from the falling head estimates. Based on these measurements, it appears that a very significant fraction of the water loaded to FSC-1, FSC-2, and FSC-4 is being lost to infiltration and that FSC-3 continues to gain water from the surrounding cells. Beneficial effects of recent additional leak repairs conducted by the District will be assessed in the next interim report.



**EXHIBIT 3-2**  
Time Series of Field-Scale Water Budget Residuals (Estimate of Infiltration/Exfiltration)

# Soils

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## 4.1 Introduction

Phase 1 and 2 PSTA work indicated that antecedent soil properties affect community development and TP removal performance (CH2M HILL, 2001). One of the key goals of the Phase 3 demonstration work is to investigate these effects on a larger scale. Also, additional smaller scale experiments (see Section 7) have been added to the Phase 3 PSTA work to document the effects of a range of soil amendments on TP removal performance.

This section summarizes the results from two soil testing events in the PSTA FSCs, February 8, 2001 (baseline) and April 16, 2002 (operational). Nine soil samples were collected in each cell during each event, at three evenly spaced locations across three transverse transects: inflow, center, and outflow. FSC-1 through FSC-3 had been previously flooded prior to the initial soil sampling event in February 2001, while FSC-4 had not yet received any flood water. Soil was composited by transect for laboratory analysis of the following parameters:

- Percent solids
- TP
- Total inorganic P (TIP)
- Total organic P (TOP)
- Residual P fractions

The three composite soil samples from the initial sampling event were then composited to provide a single cell sample for analysis of the following:

- Equilibrium P concentration at zero P ( $EPC_0$ )
- One-point sorption isotherm linear adsorption coefficient
- Initial adsorbed P at  $C = 0$

Small and large limestone rocks were excluded from all soil samples, and only the finer soil material was sampled in the limerock and scrape-down cells. Data for each of these preliminary analyses are summarized below.

## 4.2 Results

Exhibit 4-1 summarizes the February 2001 and April 2002 soil analyses from the Field-Scale PSTA Cells. Percent moisture in the limerock cells averaged approximately 32 percent. TP averaged 100 milligrams per kilogram (mg/kg), with approximately 73 percent in the inorganic form. Of the inorganic P, approximately 91 percent was calcium-bound. Of the TP, approximately 67 percent was in the calcium-bound form, and 21 percent was in residual organic forms. The scrape-down cell had a slightly lower average TP of 103 mg/kg, with approximately 66 percent in the calcium-bound form and the remainder largely in the

**EXHIBIT 4-1**

PSTA Field-Scale Soil TP Fractionation Summary

Cell	Treatment	TP	Moisture Content %	Inorganic P Fractions		Total Inorganic P	Organic P Fractions			Total Organic P
				Labile	Calcium-bound		Labile	Moderate	Residual	
February 2001										
FSC-1	Limerock	106.0	32.8	6.14	69.5	75.6	5.73	4.98	29.6	40.3
FSC-2	Limerock	104.8	27.8	5.38	72.2	77.6	4.50	2.87	19.6	27.0
FSC-3	Caprock	95.0	47.5	3.88	78.5	82.4	5.73	1.50	28.9	36.1
FSC-4	Peat	350.4	69.8	15.77	43.8	59.6	73.0	177.5	58.5	309.0
April 2002										
FSC-1	Limerock	101.3	33.9	6.4	65.9	72.3	1.4	3.4	17.8	22.6
FSC-2	Limerock	86.8	33.8	6.8	59.3	66.1	1.3	3.7	17.7	22.7
FSC-3	Caprock	111.5	55.0	3.5	58.6	62.1	7.0	4.1	29.8	40.9
FSC-4	Peat	458.0	71.0	12.1	47.5	59.6	87.2	167.6	62.5	317.3
Average										
FSC 1-2	Limerock	99.7	32.1	6.2	66.7	72.9	3.2	3.7	21.2	28.1
FSC-3	Caprock	103.2	51.3	3.7	68.6	72.2	6.4	2.8	29.4	38.5
FSC-4	Peat	404.2	70.4	13.9	45.7	59.6	80.1	172.6	60.5	313.2

Note:

A total of 3 samples composited on each transect; 3 composites composited for each cell for fractionation.

residual organic form. The organic peat soil in FSC-4 was quite different from the other three cells. The TP averaged 404 mg/kg, with approximately 94 mg/kg (23 percent) in labile forms. Approximately 233 mg/kg of TP (58 percent) was in moderately labile or residual organic forms.

Exhibit 4-2 summarizes the sorption isotherm data for the soils from the February 2001 and April 2002 sample event. The properties of the limestone and peat soils were very different in both analyses. The limestone cells had linear adsorption coefficients between 380 and 1,498 liters per kilogram (L/kg), while the peat cell coefficient was 13 and 227 L/kg for the February 2001 and April 2002 samples, respectively. The EPC<sub>0</sub> values for each event were also very different between soils. The three limestone-based cells had EPC<sub>0</sub> values between 0.001 and 0.004 milligrams per liter (mg/L), while the peat soil value was 0.362 and 0.037 mg/L, respectively.

**EXHIBIT 4-2**  
Sorption Isotherm Data from Field-Scale PSTA Cell Soils

Site	P Sorption Parameters		EPC <sub>0</sub> mg/L	r <sup>2</sup>	P Range mg/L
	Kd L/kg	So mg/kg			
<b>February 2001</b>					
FSC-1	380	-0.83	0.002	0.85	0.005- 0.038
FSC-2	614	-2.6	0.004	0.87	0.010- 0.047
FSC-3	1079	-2.5	0.002	0.78	0.007- 0.034
FSC-4	13	-4.8	0.362	0.83	0.462- 3.27
<b>April 2002</b>					
FSC-1	1184	-2.25	0.002	0.96	0.002-0.014
FSC-2	1047	-1.37	0.001	0.96	0.001-0.015
FSC-3	1498	-0.094	0.001	0.90	0.001-0.03
FSC-4	227	-8.36	0.037	0.94	0.041-0.177

Notes:

Three samples composited on each transect; three composites composited for each cell for sorption.

Kd = linear adsorption coefficient

So = initial adsorbed P at C = 0 (negative sign indicated desorbable P)

EPC<sub>0</sub> = equilibrium P concentration

# Water Quality

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## 5.1 Introduction

Water quality monitoring is being conducted at a number of stations in and around the Field-Scale PSTA site, and includes both surface water and groundwater. The primary purpose of this monitoring is to assess the fate of TP in the surface water being introduced into these PSTA Cells. Other parameters are monitored to allow interpretation of the TP dynamics observed in these waters. Water quality data trend charts for the study period are provided in Appendix C.

## 5.2 Surface Water

### 5.2.1 Field Parameters

Exhibit 5-1 summarizes the field parameter data collected during the POR. Weekly summaries are provided in Appendix B-2. Monitoring points include the inflow canal and the four PSTA demonstration cells. The reported values from the four demonstration cells are averages from the inflow, center, and outflow stations.

- **Temperature:** Weekly average water temperature in the inflow canal ranged from approximately 14 and 31 degrees Celsius (°C), while average weekly temperatures at the cells ranged from 13 to 35 °C.
- **pH:** Surface water pH increased through the three limerock cells from a value of approximately 7.7 units in the inflow canal to 8.3 in FSC-1, 8.1 in FSC-2, and 8.1 in FSC-3. There was no change in the average pH between the inflow canal and the average from FSC-4.
- **Conductivity:** Conductivity was somewhat variable over time and between cells. The conductivity in the inflow canal ranged from 893 to 1,996 micromhos per centimeter ( $\mu\text{mhos/cm}$ ). Changes to the average conductivity observed between the inflow canal and demonstration cells were less than 11 percent and were variable between cells. Based on conductivity values, there did not appear to be a net concentration or dilution of water in these cells during this operational period. The concentration of total dissolved solids (TDS) showed the same general response as conductivity.
- **Dissolved oxygen:** The average dissolved oxygen (DO) in the inflow canal was approximately 6.0 mg/L. The PSTA cell averages were between 5.8 and 9.9 mg/L during this operational period. The peat cell, FSC-4, had the lowest average DO concentration.

### 5.2.2 Phosphorus

Exhibit 5-2 summarizes the P surface water data for the 9-month POR. Weekly summaries are provided in Appendix B-3. Average TP in the inflow was 21 micrograms per liter ( $\mu\text{g/L}$ ) during this period. Monthly averages ranged from 13 to 46  $\mu\text{g/L}$ . Of this TP, an average of 50 percent was in the dissolved form, 17 percent was dissolved reactive P (DRP), and 33 percent was dissolved organic P (DOP). Outflow TP averaged 20, 15, 15, and 22  $\mu\text{g/L}$  in

## EXHIBIT 5-1

Field Parameter Measurements from the Field-Scale PSTA Cells, August 2001 - April 2002

Cell	Frequency	Time Period	Temp C	pH units	Cond µmhos/cm	TDS g/L	DO SAT	DO mg/L
Inflow Canal	Monthly	Aug-01	28.43	7.40	938	0.60	45.0	3.52
		Sep-01	28.84	7.62	1036	0.66	54.7	4.22
		Oct-01	25.15	7.64	1189	0.76	66.6	5.50
		Nov-01	21.90	7.78	1334	0.86	87.5	7.63
		Dec-01	21.43	7.74	1537	0.99	73.7	6.59
		Jan-02	20.54	7.66	1299	0.83	70.1	6.40
		Feb-02	19.96	7.77	1299	0.84	78.4	7.10
		Mar-02	23.15	8.00	1308	0.84	84.9	7.36
		Apr-02	25.50	8.00	1333	0.85	74.0	6.05
FSC-1 (entire cell)	Monthly	Aug-01	31.24	8.22	894	0.57	99.8	7.34
		Sep-01	28.76	8.49	865	0.55	106.0	8.13
		Oct-01	25.97	8.34	1038	0.66	110.4	8.90
		Nov-01	22.49	8.41	1172	0.62	118.8	10.24
		Dec-01	20.21	8.24	1287	0.82	111.4	10.03
		Jan-02	21.36	8.09	1258	0.80	104.2	9.17
		Feb-02	21.78	8.11	1233	0.79	103.4	9.00
		Mar-02	23.71	8.11	1238	0.79	84.9	7.19
		Apr-02	26.35	8.32	1371	0.88	127.2	10.17
FSC-2 (entire cell)	Monthly	Aug-01	28.42	7.76	958	0.61	51.6	4.03
		Sep-01	25.96	7.91	1089	0.70	93.7	7.58
		Oct-01	26.93	7.99	1153	0.74	111.5	8.80
		Nov-01	21.84	8.10	1559	1.00	119.7	10.32
		Dec-01	21.03	7.77	1501	0.96	77.6	7.01
		Jan-02	19.60	8.11	1167	0.75	147.4	13.92
		Feb-02	21.11	8.06	1196	0.77	115.8	10.24
		Mar-02	24.96	8.15	1265	0.81	101.3	8.35
		Apr-02	25.14	8.26	1317	0.84	94.5	7.72
FSC-3 (entire cell)	Monthly	Aug-01	29.58	7.87	732	0.47	95.4	7.23
		Sep-01	29.24	8.09	970	0.62	95.8	7.29
		Oct-01	24.95	7.77	1127	0.72	81.1	6.70
		Nov-01	21.96	7.98	1303	0.83	95.7	8.31
		Dec-01	21.07	7.95	1452	0.93	82.0	7.35
		Jan-02	23.66	8.22	1200	0.77	101.1	8.49
		Feb-02	20.97	8.20	1196	0.77	99.8	8.86
		Mar-02	24.83	8.19	1258	0.81	106.1	8.76
		Apr-02	26.12	8.22	1317	0.84	87.0	7.00
FSC-4 (entire cell)	Monthly	Sep-01	27.35	7.53	965	0.62	59.7	4.64
		Oct-01	26.49	7.63	1101	0.70	68.3	5.33
		Nov-01	21.90	7.60	1245	0.78	71.9	6.13
		Dec-01	24.21	7.76	1348	0.87	72.6	6.03
		Jan-02	23.96	7.58	1345	0.86	52.1	4.29
		Feb-02	21.69	7.80	1270	0.81	76.2	6.63
		Mar-02	23.70	7.85	1260	0.81	85.9	7.21
		Apr-02	25.21	7.82	1298	0.83	71.4	5.79
Inflow Canal	LongTerm	Aug 01 - Apr 02	23.98	7.69	1240	0.79	70.1	5.98
FSC-1	LongTerm	Aug 01 - Apr 02	24.77	8.27	1126	0.70	108.4	8.97
FSC-2	LongTerm	Aug 01 - Apr 02	23.29	8.09	1221	0.78	114.6	9.90
FSC-3	LongTerm	Aug 01 - Apr 02	26.25	8.10	1099	0.70	96.8	7.81
FSC-4	LongTerm	Sept 01 - Apr 02	24.74	7.68	1196	0.76	70.4	5.77

Note:

FSC 1-4 averages include inflow, center, and outflow stations.

EXHIBIT 5-2

Phosphorus Water Quality Data from the Field-Scale PSTA Cells, August 2001 - April 2002

Cell	Freq	Time Period	TP (µg/L)				TDP (µg/L)				DRP (µg/L)				TPP (µg/L)				DOP (µg/L)			
			InfCnl	Inflow	stn_1/2	Outflow	InfCnl	Inflow	stn_1/2	Outflow	InfCnl	Inflow	stn_1/2	Outflow	InfCnl	Inflow	stn_1/2	Outflow	InfCnl	Inflow	stn_1/2	Outflow
FSC-1	Monthly	Aug-01	19	24	19	19	8	9	8	6	3	1	1	1	11	15	11	11	6	8	7	5
		Sep-01	21	--	--	21	8	--	--	8	3	--	--	3	14	--	--	19	6	--	--	6
		Oct-01	16	26	15	14	8	12	7	6	9	3	3	3	7	15	8	8	2	9	4	4
		Nov-01	13	17	--	20	7	7	--	8	2	1	--	2	7	10	--	15	5	6	--	6
		Dec-01	15	21	--	45	8	9	--	--	1	1	--	--	8	12	--	--	7	8	--	--
		Jan-02	13	22	17	18	6	8	7	6	2	1	1	1	7	14	10	12	4	7	6	5
		Feb-02	18	16	14	18	10	8	7	7	3	2	2	1	8	8	7	10	7	6	5	7
		Mar-02	38	25	--	17	11	10	--	7	4	7	--	4	27	15	--	10	8	3	--	4
		Apr-02	46	25	21	30	11	12	10	9	3	1	5	2	35	13	11	21	8	11	5	7
FSC-2	Monthly	Sep-01	21	18	15	18	8	7	7	9	2	3	3	3	13	11	8	10	6	5	4	6
		Oct-01	15	26	14	12	7	9	8	13	6	3	3	2	7	17	6	4	3	6	5	12
		Nov-01	14	17	--	11	6	7	--	6	2	2	--	2	6	10	--	5	5	5	--	4
		Dec-01	16	20	17	22	9	9	9	14	2	2	1	2	7	11	8	10	8	7	8	12
		Jan-02	13	19	14	15	6	6	6	6	2	2	1	2	7	13	8	9	4	4	5	4
		Feb-02	18	19	12	14	10	8	8	7	3	3	1	2	8	11	4	8	7	5	7	5
		Mar-02	38	23	17	16	11	10	16	9	4	8	9	2	27	13	1	7	8	2	7	7
		Apr-02	46	28	17	19	11	14	12	10	3	10	3	6	35	14	5	8	8	4	9	5
		FSC-3	Monthly	Aug-01	19	21	17	15	8	9	8	7	3	2	1	2	11	12	9	9	6	7
Sep-01	21			15	14	13	7	7	6	6	4	2	3	3	13	8	8	7	4	5	3	2
Oct-01	15			18	11	13	7	7	6	6	6	3	2	2	7	11	5	7	3	4	4	4
Nov-01	13			14	14	11	7	7	6	6	3	1	1	1	5	7	8	6	4	6	5	5
Dec-01	16			25	18	16	9	8	7	8	2	1	1	2	7	17	11	8	8	7	6	8
Jan-02	14			27	28	17	6	7	6	5	2	1	2	2	8	20	22	12	4	6	4	4
Feb-02	18			15	14	14	10	8	6	7	3	2	3	2	8	7	8	8	7	6	4	5
Mar-02	38			22	21	16	11	10	11	7	4	11	2	3	27	12	10	9	8	0	9	4
Apr-02	46			32	25	22	11	9	10	10	3	2	7	6	35	23	15	12	8	7	3	6
FSC-4	Monthly	Nov-01	15	11	--	--	7	6	--	--	2	3	--	--	8	5	--	--	5	3	--	--
		Dec-01	15	37	24	23	8	21	10	10	1	12	1	2	8	16	14	12	7	9	9	9
		Jan-02	14	16	22	17	6	8	10	10	2	2	1	3	8	8	12	7	5	6	9	7
		Feb-02	20	16	17	20	11	6	7	9	3	3	2	2	8	10	10	10	8	3	5	7
		Mar-02	45	24	--	21	13	11	--	11	3	4	--	4	32	13	--	11	9	7	--	7
		Apr-02	44	17	41	35	10	8	14	16	3	2	8	9	34	9	27	19	7	6	6	6
FSC-1	POR	Aug 01 - Apr 02	21	22	17	20	9	9	8	7	3	2	2	2	16	13	9	13	6	7	5	5
FSC-2	POR	Sept 01 - Apr 02	21	21	15	15	8	9	9	10	3	4	3	3	14	12	6	8	6	5	6	7
FSC-3	POR	Aug 01 - Apr 02	20	21	18	15	8	8	7	7	3	3	2	3	13	13	11	9	5	5	5	4
FSC-4	POR	Nov 01 - Apr 02	24	20	26	22	9	10	10	11	3	4	3	4	17	10	16	11	7	6	7	7

FSC-1 through FSC-4, respectively. The lowest average monthly outflow TP concentrations were 11 µg/L in FSC-2 and FSC-3.

The time to achieve positive performance (outflow concentrations less than inflow concentrations) was variable between cells. Approximately 5 months of operation were required in FSC-1 and 4 months in FSC-2. Monthly average outflow TP concentration was always lower than the monthly inflow in FSC-3 and never was lower during this period-of-record in FSC-4 (peat-based cell).

Exhibit 5-3 provides an estimated mass balance for TP in FSC-1 through FSC-4 during the POR. Weekly summaries are provided in Appendix B-4. Mass loadings to the four cells were highly variable because of variable inflow pumping rates, and ranged from 0.37 to 0.84 grams per square meter per year (g/m<sup>2</sup>/y). FSC-2 received the highest water and TP load during this period. Average TP removal rates were also quite variable, ranging from -0.09 to 0.52 g/m<sup>2</sup>/y. Resulting  $k_1$  values ranged from approximately -0.7 to 8.5 meters per year (m/y).

### **5.2.3 Nitrogen**

Exhibit 5-4 summarizes monthly nitrogen data. Average inflow total nitrogen (TN) was between 1.4 and 1.8 mg/L. The majority of this TN was in the organic form (approximately 99 percent). Average outflow TN for the four cells ranged from 1.3 to 2.2 mg/L with no significant increase or decrease observed for any of the nitrogen forms. The TN mass balance summarized in Exhibit 5-5 showed no net increase or removal in these cells.

### **5.2.4 Other Parameters**

Exhibit 5-6 summarizes the analytical data for total organic carbon (TOC), total suspended solids (TSS), calcium (Ca), alkalinity, and chlorides. TOC concentrations were approximately unchanged between the cell inlets and outlets. The outflow TSS concentrations for these three cells were all less than approximately 3.5 mg/L. Calcium concentrations in the limestone cells declined slightly (9 to 13 percent) while the peat had a slight increase (7 percent). There were no consistent changes in alkalinity or chlorides in any of the cells.

## **5.3 Groundwater**

Installation of the groundwater wells was completed in August 2001. Exhibit 5-7 summarizes the TP groundwater data for the POR. Average TP in all wells was 14 µg/L, ranging from 12 to 19 µg/L during this POR. TP concentrations averaged 14 µg/L in the internal wells. The well located on the western berm of FSC-4 exhibited the highest average concentration of 19 µg/L. The lowest average concentration was observed at the well located near the inflow of FSC-1 with 12 µg/L.

**EXHIBIT 5-3**

Total Phosphorus Mass Balance from the Field-Scale PSTA Cells, August 2001 - April 2002

Cell	Freq	Time Period	TP (µg/L)		Flow (m <sup>3</sup> /d)			HLR (cm/d)			MB_TP (g/m <sup>2</sup> /y)		Removal		Calc_k (m/y)
			Inflow	Outflow	Inflow	Outflow	Average	q_in	q_out	q_avg	Inflow	Outflow	(g/m <sup>2</sup> /y)	(%)	
FSC-1	Monthly	Aug-01	19	19	1469.0	1406.1	1437.6	7.26	6.95	7.10	0.510	0.472	0.038	7.39	0.86
		Sep-01	21	21	506.0	204.4	355.2	2.50	1.01	1.76	0.192	0.077	0.114	59.61	0.00
		Oct-01	18	14	1387.4	633.9	1010.7	6.86	3.13	4.99	0.450	0.165	0.286	63.45	4.07
		Nov-01	13	20	553.8	101.3	327.6	2.74	0.50	1.62	0.133	0.037	0.097	72.56	-2.40
		Dec-01	18	45	657.4	56.7	357.0	3.25	0.28	1.76	0.208	0.046	0.162	78.07	-6.01
		Jan-02	14	18	2237.6	893.6	1565.6	11.06	4.42	7.74	0.562	0.292	0.271	48.12	-7.39
		Feb-02	18	18	2651.3	1465.3	2058.3	13.10	7.24	10.17	0.868	0.478	0.390	44.95	0.15
		Mar-02	29	17	2223.1	1080.2	1651.6	10.99	5.34	8.16	1.163	0.338	0.825	70.96	15.33
		Apr-02	39	30	1832.3	758.6	1295.4	9.06	3.75	6.40	1.297	0.409	0.888	68.49	6.38
FSC-2	Monthly	Sep-01	21	18	1686.5	956.7	1321.6	8.33	4.73	6.53	0.642	0.305	0.336	52.42	4.19
		Oct-01	16	12	3373.0	2162.1	2767.6	16.67	10.69	13.68	0.987	0.477	0.510	51.71	14.13
		Nov-01	14	11	1650.8	1047.1	1348.9	8.16	5.17	6.67	0.417	0.200	0.217	51.98	6.77
		Dec-01	17	22	2356.8	889.2	1623.0	11.65	4.39	8.02	0.701	0.349	0.353	50.27	-8.09
		Jan-02	14	15	2187.7	975.5	1581.6	10.81	4.82	7.82	0.546	0.257	0.289	52.99	-1.51
		Feb-02	19	14	2923.0	1274.6	2098.8	14.45	6.30	10.37	0.979	0.325	0.654	66.79	10.31
		Mar-02	29	16	3040.5	1436.2	2238.4	15.03	7.10	11.06	1.563	0.421	1.142	73.07	22.68
		Apr-02	40	19	2763.1	1534.8	2149.0	13.66	7.59	10.62	1.994	0.512	1.482	74.31	29.89
FSC-3	Monthly	Aug-01	19	15	1912.9	2464.8	2188.8	9.45	12.18	10.82	0.638	0.678	-0.040	-6.22	7.63
		Sep-01	20	13	1768.6	2119.9	1944.2	8.74	10.48	9.61	0.650	0.497	0.153	23.52	15.76
		Oct-01	15	13	2214.9	2715.7	2465.3	10.95	13.42	12.18	0.613	0.629	-0.016	-2.62	7.92
		Nov-01	13	11	942.9	2796.2	1869.6	4.66	13.82	9.24	0.219	0.561	-0.342	-156.23	4.93
		Dec-01	18	16	400.4	404.5	402.5	1.98	2.00	1.99	0.128	0.117	0.011	8.95	0.75
		Jan-02	16	17	373.6	448.6	411.1	1.85	2.22	2.03	0.104	0.140	-0.035	-33.63	-0.79
		Feb-02	18	14	1224.3	1855.8	1540.0	6.05	9.17	7.61	0.398	0.478	-0.081	-20.30	6.42
		Mar-02	28	16	420.5	1715.5	1068.0	2.08	8.48	5.28	0.214	0.495	-0.281	-131.04	10.95
		Apr-02	41	22	441.0	1635.7	1038.3	2.18	8.08	5.13	0.326	0.657	-0.330	-101.31	11.45
FSC-4	Monthly	Nov-01	11	--	1450.4	0.0	725.2	7.17	0.00	3.58	0.288	--	--	--	--
		Dec-01	22	23	2178.3	991.7	1585.0	10.77	4.90	7.83	0.851	0.408	0.443	52.02	-1.50
		Jan-02	14	17	2620.0	857.4	1738.7	12.95	4.24	8.59	0.662	0.261	0.401	60.60	-5.82
		Feb-02	20	20	2483.2	511.9	1497.6	12.27	2.53	7.40	0.878	0.182	0.696	79.28	-0.14
		Mar-02	33	21	2487.9	171.6	1329.7	12.30	0.85	6.57	1.466	0.065	1.401	95.57	10.60
		Apr-02	28	35	2052.5	514.9	1283.7	10.14	2.54	6.34	1.049	0.322	0.727	69.31	-4.67
FSC-1	POR	Aug 01 - Apr 02	21	20	1520.0	726.2	1123.1	7.51	3.59	5.55	0.565	0.262	0.303	53.61	0.60
FSC-2	POR	Sept 01 - Apr 02	20	15	2356.1	1168.3	1762.2	11.64	5.77	8.71	0.839	0.318	0.521	62.10	8.54
FSC-3	POR	Aug 01 - Apr 02	19	15	1079.9	1761.9	1420.9	5.34	8.71	7.02	0.374	0.468	-0.094	-25.02	6.82
FSC-4	POR	Nov 01 - Apr 02	21	22	1467.4	353.3	910.4	7.25	1.75	4.50	0.547	0.137	0.410	74.91	-0.68

EXHIBIT 5-4

Nitrogen Water Quality Data from the Field-Scale PSTA Cells, August 2001 - April 2002

Cell	Freq	Time Period	TN_mg/L		TKN_mg/L		NO <sub>2</sub> NO <sub>3</sub> _mg/L		NH <sub>3</sub> _mg/L		OrgN_mg/L	
			Inflow	Outflow	Inflow	Outflow	Inflow	Outflow	Inflow	Outflow	Inflow	Outflow
FSC-1	Monthly	Aug-01	2.53	2.86	2.53	2.86	0.03	0.03	0.08	0.09	2.45	2.78
		Oct-01	3.26	3.23	3.14	3.23	0.12	0.03	0.14	0.06	3.00	3.17
		Dec-01	0.50	--	0.50	--	--	--	--	--	--	--
		Feb-02	1.75	1.50	1.45	1.35	0.69	0.37	0.06	0.03	1.39	1.32
		Mar-02	0.24	--	0.50	--	0.24	--	0.10	--	0.40	--
		Apr-02	1.12	1.40	1.12	1.40	0.10	0.10	0.10	0.09	1.03	1.31
FSC-2	Monthly	Sep-01	2.68	2.45	2.63	2.45	0.05	0.03	0.10	0.05	2.53	2.40
		Oct-01	3.63	2.48	3.45	2.39	0.18	0.09	0.08	0.05	3.37	2.34
		Dec-01	0.50	0.50	0.50	0.50	--	--	--	--	--	--
		Feb-02	2.36	2.24	1.66	1.85	0.71	0.38	0.03	0.03	1.63	1.82
		Mar-02	0.23	2.27	0.50	1.96	0.23	0.31	0.12	0.08	0.38	1.88
		Apr-02	1.36	0.70	1.26	0.70	0.10	0.10	0.12	0.06	1.14	0.64
FSC-3	Monthly	Aug-01	2.57	2.97	2.57	2.97	0.03	0.03	0.11	0.07	2.46	2.90
		Sep-01	2.91	2.53	2.91	2.53	0.03	0.03	0.07	0.05	2.84	2.48
		Oct-01	3.20	2.24	2.98	2.24	0.22	0.03	0.13	0.08	2.85	2.16
		Dec-01	0.50	0.50	0.50	0.50	--	--	--	--	--	--
		Feb-02	1.70	2.42	1.40	1.76	0.69	0.63	0.03	0.03	1.37	1.73
		Mar-02	0.30	0.06	0.50	0.50	0.31	0.06	0.09	0.70	0.41	0.00
FSC-4	Monthly	Dec-01	0.50	0.50	0.50	0.50	--	--	--	--	--	--
		Feb-02	3.13	1.85	1.85	1.50	0.81	0.80	0.03	0.03	1.82	1.47
		Mar-02	0.27	--	0.50	--	0.27	--	0.11	--	0.39	--
		Apr-02	1.82	1.68	1.82	1.68	0.05	0.05	0.38	0.26	1.44	1.42
FSC-1	POR	Aug 01 - Apr 02	1.57	2.25	1.54	2.21	0.23	0.13	0.10	0.07	1.65	2.14
FSC-2	POR	Sept 01 - Apr 02	1.79	1.77	1.67	1.64	0.25	0.18	0.09	0.06	1.81	1.81
FSC-3	POR	Sept 01 - Apr 02	1.80	1.78	1.75	1.74	0.23	0.14	0.09	0.17	1.87	1.81
FSC-4	POR	Dec 01 - Apr 02	1.43	1.34	1.17	1.23	0.38	0.43	0.17	0.15	1.22	1.44

## EXHIBIT 5-5

Total Nitrogen Mass Balances from the Field-Scale PSTA Cells, August 2001 - April 2002

Cell	Freq	Time Period	TN (mg/L)		Flow (m <sup>3</sup> /d)			HLR (cm/d)			MB_TN (g/m <sup>2</sup> /y)		Removal		Calc_k (m/y)
			Inflow	Outflow	Inflow	Outflow	Average	q_in	q_out	q_avg	Inflow	Outflow	(g/m <sup>2</sup> /y)	(%)	
FSC-1	Monthly	Aug-01	2.53	2.86	1469.0	1406.1	1437.6	7.26	6.95	7.10	67.04	72.54	-5.50	-8.20	-3.18
		Oct-01	3.26	3.23	1387.4	633.9	1010.7	6.86	3.13	4.99	81.46	36.94	44.53	54.66	0.14
		Dec-01	0.50	--	657.4	56.7	357.0	3.25	0.28	1.76	5.93	--	--	--	--
		Feb-02	1.75	1.50	2651.3	1465.3	2058.3	13.10	7.24	10.17	83.70	39.65	44.05	52.63	5.72
		Mar-02	0.24	--	2223.1	1080.2	1651.6	10.99	5.34	8.16	9.62	--	--	--	--
		Apr-02	1.12	1.40	1832.3	758.6	1295.4	9.06	3.75	6.40	37.02	19.16	17.86	48.25	-5.21
FSC-2	Monthly	Sep-01	2.68	2.45	1686.5	956.7	1321.6	8.33	4.73	6.53	81.53	42.28	39.25	48.14	2.14
		Oct-01	3.63	2.48	3373.0	2162.1	2767.6	16.67	10.69	13.68	220.87	96.72	124.14	56.21	19.02
		Dec-01	0.50	0.50	2356.8	889.2	1623.0	11.65	4.39	8.02	21.26	8.02	13.24	62.27	0.00
		Feb-02	2.36	2.24	2923.0	1274.6	2098.8	14.45	6.30	10.37	124.17	51.50	72.67	58.52	1.90
		Mar-02	0.23	2.27	3040.5	1436.2	2238.4	15.03	7.10	11.06	12.62	58.81	-46.19	-366.18	-92.44
		Apr-02	1.36	0.70	2763.1	1534.8	2149.0	13.66	7.59	10.62	67.79	19.38	48.41	71.41	25.75
FSC-3	Monthly	Aug-01	2.57	2.97	1912.9	2464.8	2188.8	9.45	12.18	10.82	88.68	132.05	-43.37	-48.91	-5.71
		Sep-01	2.91	2.53	1768.6	2119.9	1944.2	8.74	10.48	9.61	92.84	96.75	-3.91	-4.21	4.91
		Oct-01	3.20	2.24	2214.9	2715.7	2465.3	10.95	13.42	12.18	127.85	109.73	18.12	14.17	15.86
		Dec-01	0.50	0.50	400.4	404.5	402.5	1.98	2.00	1.99	3.61	3.65	-0.04	-1.01	0.00
		Feb-02	1.70	2.42	1224.3	1855.8	1540.0	6.05	9.17	7.61	37.55	80.84	-43.30	-115.32	-9.75
		Mar-02	0.30	0.06	420.5	1715.5	1068.0	2.08	8.48	5.28	2.28	1.86	0.42	18.41	31.01
		Apr-02	1.40	1.73	441.0	1632.8	1036.9	2.18	8.07	5.12	11.14	50.95	-39.82	-357.57	-3.96
FSC-4	Monthly	Dec-01	0.50	0.50	2178.3	991.7	1585.0	10.77	4.90	7.83	19.65	8.94	10.70	54.47	0.00
		Feb-02	3.13	1.85	2483.2	511.9	1497.6	12.27	2.53	7.40	140.21	17.08	123.12	87.81	14.21
		Mar-02	0.27	--	2487.9	171.6	1329.7	12.30	0.85	6.57	12.12	--	--	--	--
		Apr-02	1.82	1.68	2052.5	514.9	1283.7	10.14	2.54	6.34	67.39	15.60	51.78	76.84	1.85
FSC-1	POR	Aug 01 - Apr 02	1.57	2.25	1520.0	726.2	1123.1	7.51	3.59	5.55	42.93	29.44	13.49	31.43	-7.32
FSC-2	POR	Sept 01 - Apr 02	1.79	1.77	2356.1	1168.3	1762.2	11.64	5.77	8.71	76.18	37.37	38.81	50.95	0.34
FSC-3	POR	Sept 01 - Apr 02	1.80	1.78	1079.9	1761.9	1420.9	5.34	8.71	7.02	35.01	56.50	-21.50	-61.41	0.28
FSC-4	POR	Dec 01 - Apr 02	1.43	1.34	1467.4	353.3	910.4	7.25	1.75	4.50	37.85	8.56	29.29	77.38	1.03

EXHIBIT 5-6

Averages of Water Quality Data from the Field-Scale PSTA Cells, August 2001 - April 2002

Cell	Freq	Time Period	TOC mg/L		TSS mg/L		CA mg/L		ALK mg/L		CL mg/L			
			Inflow	Outflow	Inflow	Outflow	Inflow	Outflow	Inflow	Outflow	Inflow	Outflow		
FSC-1	Monthly	Aug-01	36.0	32.0	0.8	1.1	45.7	43.5	200	188	--	--		
		Oct-01	40.5	40.0	5.3	2.0	53.5	44.1	295	220	167	154		
		Nov-01	39.2	--	--	--	76.0	--	228	--	--	--		
		Dec-01	36.0	--	--	--	77.9	--	309	--	257	--		
		Jan-02	--	--	--	--	80.5	70.7	279	255	252	231		
		Feb-02	38.0	38.0	2.3	1.8	81.3	94.0	330	265	221	202		
		Mar-02	40.0	--	30.0	--	65.2	--	262	--	208	--		
		Apr-02	38.0	41.0	1.0	1.0	61.1	46.2	262	238	174	199		
FSC-2	Monthly	Sep-01	41.0	41.0	7.5	2.5	79.2	77.2	268	275	155	164		
		Oct-01	41.0	40.0	2.8	0.8	62.9	50.4	280	270	166	154		
		Nov-01	39.3	--	--	--	103.0	--	235	--	--	--		
		Dec-01	34.0	41.0	--	--	83.4	84.3	311	265	263	254		
		Jan-02	--	--	--	--	101.0	76.4	276	273	227	235		
		Feb-02	38.0	39.0	1.8	1.8	82.4	106.0	335	283	227	218		
		Mar-02	41.0	46.0	6.0	3.0	64.0	61.1	272	255	144	154		
		Apr-02	37.0	39.0	3.0	1.0	58.2	50.7	267	250	124	124		
FSC-3	Monthly	Aug-01	40.0	32.0	2.8	1.3	52.5	50.2	210	210	--	--		
		Sep-01	42.0	42.0	5.0	5.3	77.4	64.7	270	250	153	158		
		Oct-01	42.0	38.0	2.9	2.9	64.0	47.6	270	230	154	143		
		Nov-01	40.1	40.0	--	--	66.0	57.4	242	237	--	--		
		Dec-01	37.0	40.0	--	--	71.2	68.4	289	245	257	258		
		Jan-02	--	--	--	--	68.7	60.2	246	240	240	240		
		Feb-02	38.0	39.0	2.8	2.3	96.4	96.8	318	288	222	206		
		Mar-02	37.0	43.0	7.0	4.0	113.0	76.6	260	263	129	129		
FSC-4	Monthly	Apr-02	37.0	37.5	5.0	5.0	60.9	61.7	253	267	165	165		
		Nov-01	43.6	--	--	--	85.9	--	288	--	--	--		
		Dec-01	36.0	39.5	--	--	85.4	79.3	293	284	248	257		
		Jan-02	--	--	--	--	74.0	103.0	276	288	239	221		
		Feb-02	39.0	40.0	2.3	1.8	93.7	96.1	333	300	225	205		
		Mar-02	42.0	--	6.0	--	76.3	--	275	--	149	--		
FSC-4	Monthly	Apr-02	37.0	41.0	5.0	5.0	71.3	67.2	287	283	190	143		
		FSC-1	POR	Aug 01 - Apr 02	38.2	37.8	7.9	1.5	67.6	59.7	271	233	213	197
		FSC-2	POR	Sept 01 - Apr 02	38.8	41.0	4.2	1.8	79.3	72.3	280	267	187	186
		FSC-3	POR	Aug 01 - Apr 02	39.1	38.9	4.2	3.5	74.5	64.8	262	248	189	186
FSC-4	POR	Nov 01 - Apr 02	39.5	40.2	4.4	3.4	81.1	86.4	292	289	210	206		

**EXHIBIT 5-7**Total Phosphorus ( $\mu\text{g/L}$ ) in Groundwater from the Field-Scale PSTA Cells, September 2001 – April 2002

<b>Perimeter Wells</b>	<b>Sep-01</b>	<b>Oct-01</b>	<b>Nov-01</b>	<b>Dec-01</b>	<b>Jan-02</b>	<b>Feb-02</b>	<b>Mar-02</b>	<b>Apr-02</b>	<b>Average</b>
FSC-1 Eastern Berm	13	13	12	13	11	9	12	18	13
FSC-1 Inflow Berm	11	11	13	12	12	11	13	13	12
FSC-1 Outflow Berm	17	14	19	19	20	13	21	26	19
FSC-3 Inflow Berm	13	11	13	13	12	12	14	15	13
FSC-3 Outflow Berm	10	10	13	16	16	10	18	17	14
FSC-4 Western Berm	23	19	22	19	20	15	16	18	19
<b>Average</b>	<b>15</b>	<b>13</b>	<b>15</b>	<b>15</b>	<b>15</b>	<b>12</b>	<b>16</b>	<b>18</b>	<b>15</b>
<b>Internal Wells</b>									
FSC-1	20	12	12	10	10	10	15	13	13
FSC-2	16	13	16	13	13	11	14	12	14
FSC-3	14	17	22	15	14	17	10	20	16
FSC-4	11	11	14	12	14	11	13	15	13
<b>Average</b>	<b>15</b>	<b>13</b>	<b>16</b>	<b>13</b>	<b>13</b>	<b>12</b>	<b>13</b>	<b>15</b>	<b>14</b>

# Biological Community

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## 6.1 Introduction

Biological sampling is being conducted in the PSTA FSCs to document the form and function of the biological community. This sampling includes documentation of periphyton biomass; periphyton content of calcium, phosphorus, and nitrogen; chlorophyll; and algal taxonomy. Macrophyte biomass is also measured when vascular plants are encountered in periphyton core samples. Community metabolism is being estimated in the Field-Scale PSTA cells based on continuous measurements of DO.

## 6.2 Periphyton

Exhibit 6-1 summarizes periphyton data from the PSTA FSCs for the POR. Periphyton results from August 2001–January 2002 were from samples collected at the center station for each cell. The April 2002 data were reported as an average of three stations (inflow, center, outflow) for each cell. Average periphyton dry weight biomass was highest in FSC-2 at approximately 828 g/m<sup>2</sup> and lowest in FSC-4 at 48 g/m<sup>2</sup>. Average ash-free dry weight (AFDW) biomass in these cells ranged from 19 to 146 g/m<sup>2</sup>. Calcium made up a relatively small proportion of the ash weight (21 to 35 percent). Periphyton TP ranged from 0.03 to 0.24 g/m<sup>2</sup> (296 to 863 mg/kg) and was approximately 0.19 percent of the AFDW in FSC-1, and 0.17 percent in FSC-2, FSC-3, and FSC-4. Algal biovolume was highest in FSC-2 and lowest in FSC-4. On a biovolume basis, blue-green algal species dominated FSC-1 periphyton, green algal species dominated FSC-2 periphyton, and diatoms dominated the algal flora in FSC-3 and FSC-4. Appendix D presents the detailed list of algal species, cell counts, and biovolumes for the Field-Scale PSTAs during this quarter.

Exhibit 6-2 summarizes the detailed periphyton P fractionation analyses from the Field-Scale PSTA Cells (October 2001 and April 2002). Results are from three periphyton samples composited from each station (inflow, center, and outflow) and then further composited for each cell for fractionation. Average TP ranged from 143 to 154 mg/kg, with approximately 55 percent in the organic form. Of this organic TP, approximately 34 percent was recalcitrant.

EXHIBIT 6-1

Periphyton Data from the Field-Scale PSTA Cells, August 2001 - April 2002

Cell	Freq	Time Period	Periphyton Biomass (g/m <sup>2</sup> )			Ca		Chl a		TP		TIP		TKN	
			Dry Wt	Ash Wt	AFDW	(g/m <sup>2</sup> )	(mg/kg)								
FSC-1	Monthly	Aug-01	SL	SL	SL	44.7	SL	0.04	SL	0.101	SL	0.027	SL	NC	NC
		Sep-01	MC	MC	43	51.3	MC	ND	ND	0.078	MC	0.016	MC	NC	NC
		Oct-01	562	381	163	20.3	36071	0.24	425	0.328	584	0.030	53	6.3	11250
		Nov-01	408	331	80	66.7	163333	0.02	52	0.115	281	0.016	39	NC	NC
		Dec-01	241	174	66	100.2	416766	0.02	84	0.106	441	0.011	48	NC	NC
		Jan-02	409	265	137	108.1	264118	0.04	94	0.170	408	0.030	69	0.6	1518
		Apr-02	24	18	5	11.0	485823	0.01	206	0.008	335	0.002	77	0.0	1852
FSC-2	Monthly	Sep-01	MC	MC	78	128.8	MC	ND	ND	0.206	MC	0.057	MC	NC	NC
		Oct-01	929	712	189	23.1	24833	0.33	353	0.353	380	0.038	41	7.4	7933
		Nov-01	1207	990	241	260.9	216154	0.06	51	0.407	337	0.081	67	NC	NC
		Dec-01	879	714	162	207.2	235625	0.05	53	0.235	268	0.044	50	NC	NC
		Jan-02	695	549	154	181.5	261053	0.08	116	0.220	316	0.060	93	0.9	1326
		Apr-02	561	454	103	177.0	312031	0.09	164	0.144	247	0.028	53	0.4	825
FSC-3	Monthly	Aug-01	MC	MC	85	107.5	MC	0.06	MC	0.093	MC	0.018	MC	NC	NC
		Sep-01	MC	MC	40	52.7	MC	ND	ND	0.068	MC	0.021	MC	NC	NC
		Oct-01	368	294	77	11.4	30976	0.14	380	0.331	900	0.026	70	3.7	10029
		Nov-01	442	375	71	42.7	96667	0.07	161	0.094	212	0.022	49	NC	NC
		Dec-01	277	222	42	80.7	291333	0.04	127	0.065	235	0.014	49	NC	NC
		Jan-02	359	302	77	97.9	272500	0.05	140	0.080	234	0.020	52	U	U
		Apr-02	465	409	63	93.1	221820	0.03	74	0.073	178	0.012	46	0.1	399
FSC-4	Monthly	Aug-01 <sup>1</sup>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
		Sep-01 <sup>1</sup>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
		Oct-01 <sup>1</sup>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
		Nov-01	68	46	22	17.6	260000	0.02	350	0.048	713	0.005	69	NC	NC
		Dec-01	27	12	15	8.1	298750	0.01	213	0.028	1013	0.001	50	NC	NC
		Jan-02	11	6	5	4.9	445455	0.01	500	0.020	1932	0.000	82	U	U
		Apr-02 <sup>1</sup>	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
FSC-1	POR	Aug 01 - Apr 02	242	172	63	47.2	345606	0.05	182	0.100	388	0.010	63	1.4	3665
FSC-2	POR	Sept 01 - Apr 02	806	646	147	165.1	220135	0.12	150	0.240	299	0.050	59	2.3	2728
FSC-3	POR	Aug 01 - Apr 02	406	346	65	74.7	180739	0.06	147	0.110	302	0.020	51	1.0	2807
FSC-4	POR	Nov 01 - Jan 02	35	21	14	10.2	279375	0.01	354	0.030	1219	0.000	67	U	U

EXHIBIT 6-1 (Cont.)

Periphyton Data from the Field-Scale PSTA Cells, August 2001 - April 2002

Cell	Freq	Time Period	Blue-Green Algae			Diatoms			Green Algae			Total Taxa			Evenness	SWDI
			(# cells/m <sup>2</sup> )*10 <sup>9</sup>	(cm <sup>3</sup> /cm <sup>2</sup> )	(# taxa)	(# cells/m <sup>2</sup> )*10 <sup>9</sup>	(cm <sup>3</sup> /cm <sup>2</sup> )	(# taxa)	(# cells/m <sup>2</sup> )*10 <sup>9</sup>	(cm <sup>3</sup> /cm <sup>2</sup> )	(# taxa)	(# cells/m <sup>2</sup> )*10 <sup>9</sup>	(cm <sup>3</sup> /cm <sup>2</sup> )	(# taxa)		
FSC-1	Monthly	Aug-01	NC	NC	NC	NC	NC									
		Sep-01	NC	NC	NC	NC	NC									
		Oct-01	124	14.69	14	1.9	1.08	9	1.5	0.29	5	127	16.05	21	0.69	3.33
		Nov-01	NC	NC	NC	NC	NC									
		Dec-01	NC	NC	NC	NC	NC									
		Jan-02	38	1.05	19	1.1	1.75	11	0.7	1.10	8	40	3.91	38	0.71	3.86
		Apr-02	16	0.31	20	0.2	0.02	7	77.6	0.00	15	17	0.71	31	0.70	3.54
FSC-2	Monthly	Sep-01	NC	NC	NC	NC	NC									
		Oct-01	232	2.13	12	11.0	6.14	15	2.5	50.30	5	246	58.57	32	0.58	2.88
		Nov-01	NC	NC	NC	NC	NC									
		Dec-01	NC	NC	NC	NC	NC									
		Jan-02	18	2.70	13	3.0	2.29	16	3.7	24.95	9	25	29.94	38	0.79	4.31
		Apr-02	114	2.48	15	5.8	6.38	14	2.5	0.26	5	122	9.12	34	0.67	3.60
FSC-3	Monthly	Aug-01	NC	NC	NC	NC	NC									
		Sep-01	NC	NC	NC	NC	NC									
		Oct-01	157	1.68	10	4.6	1.87	8	2.9	0.16	4	165	3.71	22	0.62	2.78
		Nov-01	NC	NC	NC	NC	NC									
		Dec-01	NC	NC	NC	NC	NC									
		Jan-02	66	1.83	17	1.3	1.90	11	0.5	0.14	4	68	3.87	32	0.68	3.48
		Apr-02	102	1.77	19	2.4	2.34	9	0.9	0.01	2	105	4.12	30	0.67	3.46
FSC-4	Monthly	Aug-01 <sup>1</sup>	NC	NC	NC	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
		Sep-01 <sup>1</sup>	NC	NC	NC	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
		Oct-01 <sup>1</sup>	NO	NO	NO	NO	NO									
		Nov-01	NC	NC	NC	NC	NC									
		Dec-01	NC	NC	NC	NC	NC									
		Jan-02	2	0.02	16	0.3	0.14	15	0.1	0.02	5	2	0.18	36	0.76	4.07
		Apr-02 <sup>1</sup>	NM	NM	NM	NM	NM									
FSC-1	POR	Aug 01 - Apr 02	60	5.35	18	1.1	0.95	9	26.6	0.46	9	61	6.89	30	0.70	3.57
FSC-2	POR	Sept 01 - Apr 02	121	2.44	13	6.6	4.94	15	2.9	25.17	6	131	32.54	35	0.68	3.60
FSC-3	POR	Aug 01 - Apr 02	108	1.76	15	2.8	2.03	9	1.4	0.10	3	113	3.90	28	0.66	3.24
FSC-4	POR	Nov 01 - Jan 02	2	0.02	16	0.3	0.14	15	0.1	0.02	5	2	0.18	36	0.76	4.07

Notes:

Periphyton data collected monthly from August 2001-December 2001, and quarterly beginning in 2002.

NC = Not collected, parameter collected quarterly.

NM = No periphyton, mat insufficient at time of sample.

NO = Cell was not yet operational.

MC =Missing calculation, laboratory did not report dry weight preventing calculation of metric.

SL = Sample lost, bottle broke at lab.

ND = No data available because of inadvertent laboratory error.

U = Undetected.

**EXHIBIT 6-2**

Periphyton Phosphorus Fractionation Data Summary from the Field-Scale PSTA Cells, October 2001 and April 2002

Cell	Moisture %	TP mg/kg	Inorganic Phosphorus Fractions		Organic Phosphorus Fractions		
			Labile	Calcium-Bound	Labile	Moderately Labile	Residual
<b>October 2001</b>							
FSC-1	75.0	176.5	1.730	71.04	42.16	15.32	40.63
FSC-2	77.2	142.7	1.586	47.40	46.6	10.04	26.56
FSC-3	84.5	160.2	1.718	45.01	49.12	10.96	37.52
<b>April 2002</b>							
FSC-1	80.3	110.5	3.800	24.30	35.70	9.80	15.90
FSC-2	82.2	156.0	3.700	37.70	55.40	11.00	24.30
FSC-3	79.2	149.6	3.400	46.40	27.90	8.20	22.30
<b>Average</b>							
FSC-1	77.7	143.5	2.765	47.70	38.90	12.60	28.30
FSC-2	79.7	149.4	2.643	42.60	51.00	10.50	25.40
FSC-3	81.9	154.9	2.559	45.70	38.50	9.60	29.90

Notes:

A total of 3 samples composited on each transect; 3 composites composited for each cell for fractionation.  
Sufficient periphyton was not available in FSC-4 at the time of sampling in either month.

## 6.3 Macrophytes

Biomass estimates were made for macrophytes encountered in the periphyton core samples. Dominant macrophyte species included the macroalga *Chara*, spikerush (*Eleocharis cellulosa*), and narrow-leaf cattail (*Typha latifolia*). Average aboveground, dry-weight macrophyte biomass ranged from a low of 28.8 g/m<sup>2</sup> in FSC-3 to a high of 246 g/m<sup>2</sup> in FSC-1 (see Exhibit 6-3).

## 6.4 Community Metabolism

Exhibit 6-4 summarizes the PSTA Field-Scale community metabolism data. Weekly summaries are provided in Appendix B-5. Estimated average POR gross primary productivity (GPP) ranged from 1.2 grams (g) of O<sub>2</sub> per square meter per day (O<sub>2</sub>/m<sup>2</sup>/d) in FSC-3 to 3.6 g of O<sub>2</sub>/m<sup>2</sup>/d in FSC-2. Community respiration (CR) ranged from 1.3 g of O<sub>2</sub>/m<sup>2</sup>/d in FSC-3 to 3.6 g of O<sub>2</sub>/m<sup>2</sup>/d in FSC-2. The average ratio between GPP and CR in these cells was equal to 1 in FSC-1, slightly higher than 1 in FSC-2, and less than 1 in FSC-3 and FSC-4. There was no net productivity estimated for FSC-1, a very small amount of net productivity estimated for FSC-2, and a negative net production estimated in FSC-3 and FSC-4.

**EXHIBIT 6-3**

Macrophyte Biomass, August 2001 - April 2002

<b>Cell</b>	<b>Freq</b>	<b>Time Period</b>	<b>Dry Weight g/m<sup>2</sup></b>	<b>Total Solids %</b>
FSC-1	Monthly	Sep-01	97.1	8.3
		Oct-01	265.9	11.6
		Nov-01	285.4	14.7
		Dec-01	196.7	13.6
		Apr-02	280.7	15.3
FSC-2	Monthly	Sep-01	56.6	13.2
		Oct-01	70.3	11.3
		Nov-01	59.3	13.5
		Dec-01	68.0	9.4
		Apr-02	47.0	9.5
FSC-3	Monthly	Aug-01	14.2	45.4
		Sep-01	27.6	11.3
		Oct-01	15.8	9.9
		Nov-01	26.9	14.8
		Dec-01	7.5	9.2
		Apr-02	41.7	18.8
FSC-4	Monthly	Nov-01	32.0	12.8
		Dec-01	31.0	11.2
FSC-1	POR	Sept 01 - Apr 02	246.0	13.7
FSC-2	POR	Sept 01 - Apr 02	55.3	10.7
FSC-3	POR	Aug 01 - Apr 02	28.8	18.4
FSC-4	POR	Nov 01 - Dec 02	31.5	12.0

EXHIBIT 6-4

Metabolism Data from the Field-Scale PSTA Cells, August 2001 - April 2002

Cell	Freq	Time Period	GPP(day)		CR(24hr)	NPP(24hr)		NPP(day)	Avg Night	PAR(24hr)	Efficiency
			g/m <sup>2</sup> /d	g/m <sup>2</sup> /d		P/R Ratio	g/m <sup>2</sup> /d		g/m <sup>2</sup> /d		
FSC-1	Monthly	Aug-01	2.36	2.47	0.96	-0.11	0.92	0.10	32.5	1.427	
		Sep-01	1.72	1.68	1.02	0.04	0.76	0.07	15.6	3.360	
		Oct-01	1.95	1.94	1.01	0.01	0.89	0.08	23.6	1.819	
		Nov-01	1.69	1.67	1.01	0.02	0.76	0.07	20.6	1.796	
		Dec-01	2.54	2.51	1.01	0.03	1.28	0.10	15.0	3.281	
		Jan-02	3.13	3.20	0.98	-0.07	1.51	0.13	17.5	3.543	
		Feb-02	3.33	3.17	1.05	0.16	1.69	0.13	21.2	3.339	
		Mar-02	2.53	2.72	0.93	-0.19	0.96	0.11	28.8	2.052	
	Apr-02	3.65	3.57	1.02	0.08	1.56	0.15	33.6	2.081		
FSC-2	Monthly	Sep-01	3.09	2.78	1.11	0.31	1.52	0.12	17.4	4.974	
		Oct-01	3.88	3.77	1.03	0.11	1.73	0.16	29.0	2.743	
		Nov-01	5.25	5.01	1.05	0.24	2.53	0.21	21.9	4.586	
		Jan-02	3.34	3.25	1.03	0.09	1.72	0.14	18.1	3.656	
		Feb-02	3.35	3.32	1.01	0.02	1.59	0.14	20.8	3.911	
		Mar-02	3.68	3.81	0.97	-0.13	1.49	0.16	31.1	2.404	
		Apr-02	3.95	4.02	0.98	-0.07	1.60	0.17	24.8	3.308	
FSC-3	Monthly	Aug-01	1.21	1.37	0.88	-0.16	0.41	0.06	32.2	0.709	
		Sep-01	1.21	1.24	0.98	-0.02	0.48	0.05	15.3	2.656	
		Jan-02	0.82	0.91	0.91	-0.08	0.37	0.04	22.9	0.689	
		Feb-02	0.81	0.78	1.04	0.03	0.40	0.03	20.4	1.002	
		Mar-02	1.36	1.41	0.96	-0.05	0.54	0.06	30.7	0.873	
		Apr-02	1.54	1.65	0.94	-0.10	0.58	0.07	29.7	1.113	
FSC-4	Monthly	Sep-01	0.79	0.82	0.97	-0.02	0.36	0.03	13.4	1.229	
		Oct-01	2.09	2.19	0.95	-0.11	0.88	0.09	26.7	1.583	
		Nov-01	0.77	0.80	0.97	-0.03	0.37	0.03	18.0	0.820	
		Dec-01	3.85	3.83	1.00	0.02	1.93	0.16	18.4	4.038	
		Jan-02	2.26	2.45	0.92	-0.19	1.02	0.10	21.6	1.996	
		Feb-02	2.40	2.36	1.02	0.04	1.17	0.10	20.3	2.593	
		Mar-02	3.13	3.25	0.96	-0.12	1.25	0.14	28.0	2.415	
		Apr-02	3.40	3.35	1.02	0.05	1.45	0.14	33.0	1.973	
FSC-1	POR	Aug 01 - Apr 02	2.41	2.41	1.00	0.00	1.10	0.10	22.2	2.501	
FSC-2	POR	Sept 01 - Apr 02	3.58	3.56	1.01	0.02	1.62	0.15	24.0	3.348	
FSC-3	POR	Aug 01 - Apr 02	1.23	1.27	0.96	-0.05	0.49	0.05	24.9	1.323	
FSC-4	POR	Sept 01 - Apr 02	2.50	2.56	0.98	-0.06	1.10	0.11	24.1	2.137	

Note:

Based on assumed diffusion rate = 0.01 g O<sub>2</sub>/m<sub>2</sub>/h

# Continuing Operations Plan

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## 7.1 Introduction

Monitoring of the Field-Scale PSTA systems was originally intended to be finished in early 2002. Because of water availability issues and mechanical problems associated with the inflow pumps, system start up was delayed. Subsequently, in recognition of the need for a longer study POR, the District elected to extend monitoring through December 2002. This additional testing will allow up to a maximum of approximately 1 year of post-startup operations and data collection.

## 7.2 Phase 3 Scope

The Phase 3 scope includes a continuation of the routine sampling plan as described in Section 1 of this report. This scope extension adds one additional task: a study of soil pre-treatment options and effectiveness.

### 7.2.1 Efficacy of Soil Amendments

The purpose of this additional work was to document the types of soil amendments that have been successfully used elsewhere for TP retention and to test their efficacy in concert with onsite peat soils. This new task originally included three subtasks:

- Literature Review
- Soil Mixture Characterization and P Sorption/Desorption Study
- Mesocosm Study

The literature review summarized the known advantages and disadvantages of a number of possible soil amendments such as alum, alum sludge, and calcium-rich chemicals and was recently completed (CH2M HILL, July 2002b). Based on the literature review, it was decided to proceed with field testing of three chemicals (polyaluminum chloride [PACL], ferric chloride [FeCL], hydrated lime) and to not conduct the sorption/desorption study. The test mesocosms are currently under construction and are expected to operate for approximately 5 months.

### 7.2.2 Field-Scale Cell Operations Plan

This section summarizes the plan for operation of the FSCs during the remainder of Phase 3. The basic goal of this plan is to continue to provide a realistic demonstration of the ecological succession and performance of large-scale PSTAs within the current project constraints.

The primary purpose of the Field-Scale PSTA work was to quantify TP removal performance at a larger scale and to test the effects of two design variables on this performance: soil type and flow velocity (length-to-width ratio). This primary goal is being accomplished by

continuously loading the FSCs at the highest design loading rate of approximately 12 cm/d. This relatively high hydraulic loading rate (HLR) was chosen to accelerate plant community development and to shorten other potential startup transient behaviors, such as soil sorption/desorption and natural reduction of groundwater infiltration rates. This relatively high loading rate has also been found to be necessary to overcome the actual infiltration rates observed at the site.

Phase 1 and 2 PSTA research found that periphyton-dominated plant communities could be relatively easily established in constructed wetlands, but that rooted emergent macrophytes tended to eventually increase in dominance over a 1- or 2-year development period (CH2M HILL, October 2001). Factors that were observed to decrease the rate of this macrophyte invasion were increasing water depth, imported soils with apparent low density of macrophyte seeds, and the origin of source waters. Hand pulling and herbicides were also found to be effective at control of emergent macrophytes in the small-scale mesocosms. All of these practices are being used to control macrophyte populations at the Field-Scale PSTA site.

The water depth and loading schedule for each of the cells during the remainder of this project is proposed as follows:

- January 1–April 30, 2002: 30 cm and 12 cm/d
- May 1–July 15, 2002: dry and no inflow
- July 15–October 11, 2002: 30 cm and 12 cm/d
- October 12–December 31, 2002: 60 cm and 12 cm/d

## SECTION 8

# Works Cited

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CH2M HILL. July 2002a. *PSTA Research and Demonstration Project Phase 1 and 2 Summary Report (February 1999 to April 2001)*. Prepared for the South Florida Water Management District. July 2002.

CH2M HILL. July 2002b. *Periphyton-Based Stormwater Treatment Area (PSTA) Research and Demonstration Project Soil Amendment Literature Review*. Prepared for the South Florida Water Management District. July 2002.

CH2M HILL. August 2001. *Porta-PSTA Mass Balance (Destructive) Sampling Periphyton-Based Stormwater Treatment Area (PSTA) Research and Demonstration Project*. Prepared for the Florida Department of Environmental Protection and the South Florida Water Management District.

CH2M HILL. August 2000. *PSTA Research and Demonstration Project Phase 1 Summary Report*. February 1999 to March 2000.

CH2M HILL. February 2000. *Periphyton-Based Stormwater Treatment Area (PSTA) Research and Demonstration Project PSTA Research Plan*. February 2000.

# Key Dates Summary

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Under contract with the District, Team Land Development (TLD) constructed four PSTA Field-Scale Cells (FSCs) west of STA-2. Construction activities began in April 2000 on the first three FSCs. In November 2000, work began on a fourth, peat-based FSC. Monitoring activities began at the end of July 2001.

Dates of key activities conducted at the PSTA FSCs are provided below for the study period of April 2000 to April 2002.

## April 2000

- **04/27/00:** Notice to proceed issued by the District to TLD.

## May 2000

- **05/02/00:** Mobilization of heavy equipment onsite.
- **05/10/00:** TLD determines that there is a large “muck hole” in the southern one-fifth of FSC-3, and estimates muck hole to be 3 to 4 feet deep.
- **05/11/00:** Removal of muck from floor of FSC-3 (excluding hole at southwest corner) and excavation of inflow canal are complete. Weir box locations are excavated to depth equal to that of inflow canal.
- **05/18/00:** District and CH2M HILL decide that the “hole” in FSC-3 should be filled in with caprock and that the height of perimeter levees needs to be raised by 1 foot (ft).

## June 2000

- **06/14/00:** Muck removal in FSC-3 completed.
- **06/21/00:** Graded access roads around the site. Surveyors set benchmarks for the installation of the pipes and structures.
- **06/23/00:** Outflow weir structures set for FSC-2 and FSC-3.
- **06/26/00:** Outflow weir structure set for FSC-1.
- **06/28/00:** Inflow weir structure set for FSC-3.

## July 2000

- **07/05/00:** FSC-2 inflow weir structure damaged; needed to be removed and repaired.
- **07/06/00:** Repair of FSC-2 inflow weir structure completed, and structure was reset in place. Filling of FSC-1 and FSC-2 with cap rock completed.
- **07/20/00:** West perimeter and the seepage canal levees completed.
- **07/26/00:** Hole in FSC-3 filled, and grading of cell floor completed.

## August 2000

- 08/04/00: Hauling of fill for east perimeter levee completed.
- 08/08/00: Hauling of fill for internal levees completed.
- 08/14/00: Project trailer arrives onsite.
- 08/15/00: All fill for levees onsite.
- 08/17/00: Excavated culvert connections at inflow canal, seepage canal, and alternate water supply.
- 08/24/00: All level roads graded and rolled. Completed grading of FSC-1 floor. Removed rock piles from FSC-2 to allow completion of cell floor grading.
- 08/31/00: District met with TLD and declared project complete.

## September 2000

- 09/06/00: Pumps delivered onsite by Moving Water Industries (MWI). Inflow pumps for FSC-1, FSC-2, and FSC-3 set in place and started. CH2M HILL installed water level recorders at outflow weir boxes of FSC-1, FSC-2, and FSC-3. Walk through by District and CH2M HILL determines that floor of FSC-1 requires additional grading to even out high and low spots.
- 09/07/00: Installed cement bucket weights to use in FSCs to hold hose from inflow pumps in place.
- 09/08/00: Installed water level recorders in the Field-Scale inflow and outflow canals. Installed PVC 'T' diffusers on discharge pump hoses entering FSCs. Inflow pump of FSC-2 shut down because of hydraulic fluid leakage.
- 09/15/00: Increased weir heights in FSCs to 3 ft.
- 09/18/00: Final grading of FSC-1 and FSC-2 floors and north entrance completed. Pumps repaired and re-started.
- 09/19/00: Re-set weir height in FSC-2 to 2 ft. Determined that bringing in fill for FSC-4 from offsite is too expensive. Explored option of blasting a borrow pit area immediately west of site.
- 09/25/00: Rain gauge installed at Field-Scale Site.
- 09/27/00: Significant amount of leakage observed through inflow (south) berm of FSCs.

## October 2000

- 10/12/00: FSCs measured for boardwalk placement. Met with Bagley Environmental and Planting Services to discuss *Eleocharis cellulosa* planting. Decomposition study employing 1¼-inch-diameter PVC tubes, 15 cm in length, begun at Porta-PSTA site.
- 10/14/00: Second set of water collected at FSCs for P background levels.

- **10/26/00:** FSC-4 pre-construction walk through to determine size and placement of borrow area.

#### **November 2000**

- **11/02/00:** Removal of muck from borrow area completed.
- **11/06/00:** Removal of muck from inflow canal extension to FSC-4 completed. Mowed internal area of FSC-4 and removed large Brazilian pepper bushes.

#### **December 2000**

- **12/06/00:** Water level recorders removed from Field-Scale Site to prevent damage they might incur from scheduled blasting (for fill in FSC-4). All pumps turned off for blasting event.
- **12/13/00:** Successful blasting of borrow area; insignificant amount of flying debris.
- **12/20/00:** Begin installing boardwalks in FSCs. Meeting between District and CH2M HILL to finalize design of water supply pipe from STA-2 Cell 3 to inflow canal.

#### **January 2001**

- **01/03/01:** Completed removal of blasted material from borrow area; material determined to be of excellent construction quality.
- **01/24/01:** Completed re-filling and re-grading of inflow levee along FSC-1 and FSC-2 to reduce leakage from cells.

#### **February 2001**

- **02/08/01:** Baseline sediment sampling at the FSCs.
- **02/16/01:** All fill necessary to build FSC-4 levees in place.

#### **March 2001**

- **03/05/01:** Connected the agricultural ditch west of FSC-4 to the blasted borrow area.
- **03/06/01:** Completed boardwalk assembly at FSCs.
- **03/07/01:** FSC-4 inflow weir box set in place.
- **03/09/01:** Grading of levees and discharge canal roads around FSC-4 completed.
- **03/12/01:** FSC-4 outflow weir box set in place.
- **03/13/01:** *E. cellulosa* planted in FSC-1 and FSC-2.
- **03/15/01:** Installed Agri-drain and 18-inch-diameter pipe at FSC-4 outflow.
- **03/21/01:** Complete widening of inflow canal around FSC-4 inflow weir box.
- **03/22/01:** Water level recorder moved from Field-Scale outflow canal to FSC-4 outflow weir box.

- **03/27/01:** Majority of FSC-4 work completed. Walk through determined that grates need to be added to top of inflow and outflow weir boxes, all roads around cell need a final grading and rolling, and a 2-foot extension to top of inflow weir box should be added.

#### **April 2001**

- **04/19/01:** Installed PVC 'T' on discharge pump hoses for FSC-4 and FSC-3 out. Stop logs added to Agri-drains in FSC-1 and FSC-2 in attempt to reach target cell water depth of 1 ft.
- **04/24/01:** Installed additional 2-foot section to top of FSC-4 inflow weir box.
- **04/25/01:** All pumps at FSCs shut down because of drought.
- **04/26/01:** Inventory equipment that will be used at Field-Scale office. Completed sealing of new top section to the original bottom section of FSC-4 inflow weir box.
- **04/27/01:** Pilings to support pipeline from STA-2 Cell 3 set into ground; pilings were too long and required trimming.

#### **May 2001**

- **05/09/01:** STA-2 Cell 3 Western piling trimmed to proper length.
- **05/10/01:** Begin installation of water supply pipe from STA-2 Cell 3 to Field-Scale inflow canal.
- **05/11/01:** Completed cutting levees to place pipe for PSTA inflow canal. Completed back filling of inflow pipe.
- **05/14/01:** Pipe on STA-2 Cell 3 side completed; still need one more section of pipe on PSTA side.
- **05/30/01:** Water supply pipe from STA-2 Cell 3 to Field-Scale inflow canal completed.

#### **June 2001**

- **06/07/01:** GPS survey conducted at FSCs by District.
- **06/14/01:** Agri-drain stop logs removed to allow flow through water supply pipe from STA-2 Cell 3 to Field-Scale inflow canal.
- **06/20/01:** Herbicide application to cattails in FSCs.
- **06/21/01:** Survey conducted of STA-2 Cell 3 water supply pipe and Agri-drain elevations.
- **06/28/01:** All inflow pumps started at FSCs.
- **06/29/01:** FSC-4 sprayed with herbicide by helicopter.

#### **July 2001**

- **07/05/01:** Survey conducted by District on structure elevations at FSCs.
- **07/10/01:** Second application of herbicide on cattails at FSC-1, FSC-2, and FSC-3.

- **07/30/01:** ISCO samplers tested and deployed at FSCs. Two stop logs removed from STA-2 Cell 3 water supply pipe Agri-drain.
- **07/31/01:** First 24-hour composite samples collected at FSC-1, FSC-3, and inflow canal. Because of threat of hurricane, all samplers and meters secured in trailer at direction of the District.

### **August 2001**

- **08/06/01:** Deployed and programmed ISCO samplers to collect 24-hour composite samples.
- **08/07/01:** Collected 24-hour composite samples at FSC-1, FSC-3, and inflow canal.
- **08/09/01:** Collected 24-hour composite samples at FSC-1, FSC-3, and inflow canal. Shut down pumps and removed stop logs to facilitate drying out of cells for well installation during the week of August 13, 2001. Added stop logs to STA-2 Cell 3 water supply pipe Agri-drain to stop flow into inflow canal.
- **08/14/01:** Begin installation of 10 groundwater wells Field-Scale Site.
- **08/17/01:** Complete well installation at FSC-1 and FSC-3. Turned on pumps 1 and 3 and added stop logs to FSC-1 and FSC-3 outflow Agri-drains to set cell target water levels at 1 ft.
- **08/23/01:** Started pump at inflow of FSC-4.
- **08/24/01:** Removed all stop logs from STA-2 Cell 3 water supply pipe Agri-drain.
- **08/25/01:** Deployed data logger with photosynthetically active radiation (PAR) and temperature probes in FSC-3.
- **08/28/01:** Monthly sampling event conducted at FSCs.
- **08/30/01:** Collected 24-hour composite samples at FSC-1, FSC-3, and inflow canal. Collected grab samples at FSC-2.

### **September 2001**

- **09/04/01:** Collected 24-hour composite samples at FSC-2, FSC-3, and inflow canal. Grab sample collected at FSC-1 because of composite sampler malfunction.
- **09/11/01:** PVC 'T' diffuser noted off end of pump hose at FSC-3 inflow. Agri-drain at STA-2 Cell 3 water supply pipe cleared after being clogged with submerged aquatic vegetation (SAV).
- **09/25/01:** Groundwater samples collected for first time at Field-Scale Site wells.
- **09/26/01:** Installation of boardwalk extensions completed at all cells for groundwater sampling. PVC 'T' diffuser replaced on FSC-3 pump hose.
- **09/27/01:** Monthly sampling of groundwater wells and periphyton.

## **October 2001**

- **10/03/01:** Pump at FSC-1 inflow replaced. Groundwater well sampling conducted. Three (7-inch) stop logs removed from Agri-drain between STA-2 seepage canal and PSTA inflow canal. Two (5-inch) stop logs remain.
- **10/04/01:** Pump at FSC-4 increased from 1,300 to 1,600 revolutions per minute (rpm) to achieve outflow.
- **10/09/01:** Sediment traps deployed in all cells.
- **10/16/01:** One (7-inch) stop log added to Agri-drain from STA-2 seepage canal to PSTA inflow canal to stop backflow of water into seepage canal. Stakes placed in FSCs for field flow measurements (“orange method”).
- **10/23/01:** AMJ onsite to begin installation of flow meters.
- **10/24/01:** PAR bulb cleaned off. Periphyton sampling for quarterly event.

## **November 2001**

- **11/1/01:** Photos taken of FSCs. Tropical storm warning; ISCO samplers, sondes, and Infinities water level recorders removed.
- **11/2/01:** Staff gauges installed in FSCs.
- **11/6/01:** ISCO samplers, sondes, and Infinities re-deployed.
- **11/29/01:** Pumps shut down and five (7-inch) stop logs added to STA-2 Cell 3 water supply pipe Agri-drain to dry cells for vegetation maintenance. MWI onsite to replace discharge hose on FSC-3 pump; hose leak noted on November 13, 2001. Monthly sampling event.

## **December 2001**

- **12/5/01:** Surveyors onsite to perform elevation survey. Survey completed with the exception of tying into an existing benchmark.
- **12/10/01:** Removed all stop logs (five 7-inch) from STA-2 Cell 3 water supply pipe Agridrain. Removed one (7-inch) and one (5-inch) stop log from STA-2 Seepage Canal Agridrain.
- **12/13/01:** One (5-inch) stop log added to FSC-1 Agri-drain.
- **12/18/01:** Monthly sampling event.

## **January 2002**

- **1/8/02:** Pump at FSC-4 slowed down to 1,200 rpm to achieve proper flow.
- **1/10/02:** Deployed eight sediment traps along center walkways of each FSC.
- **1/15/02:** Water depth in inflow canal extremely low (0.55 ft). Water flowing in from STA-2 Cell 3 and STA-2 Seepage Canal; all stop logs removed for maximum inflow. At FSC-3 Outflow box, 13 dead fish were observed.

- **1/17/02:** Complete collection of periphyton samples from all cells.
- **1/22/02:** Monthly sampling event.
- **1/24/02:** Took pictures along the walkways of FSC-1 and FSC-2. Installed ¼-inch mesh screen on the inflow culverts to FSC-3 and FSC-4 inflow weir boxes.
- **1/29/02:** Removed bottom stop log from Agri-drain on inflow pipe from STA-2 seepage canal.

### **February 2002**

- **2/07/02:** Removed jammed stop log from the bottom of Agri-drain on inflow pipe from STA-2 Cell 3. Increased pump at FSC-3 from 1,000 to 1,600 rpm. Installed fence/screen around inflow culverts for FSC-3 and FSC-4. Flow meter main control panel board reading off for FSC-3.
- **2/12/02:** Two large leaks visible at upstream end of the seepage canal between FSC-2 and FSC-3.
- **2/22/02:** Field pictures taken.
- **2/26/02:** Monthly sampling event.

### **March 2002**

- **3/11/02:** Tracer study started for FSC-2 and FSC-4.
- **3/26/02:** Monthly sampling event.

### **April 2002**

- **4/09/02:** Collected sediment samples and re-deployed sediment traps. MWI onsite to change pump in FSC-3.
- **4/11/02:** Add one (5-inch) stop log to Agri-drain on STA-2 seepage canal to increase depth in the FSC inflow canal. Pump at FSC-4 lowered to 1,100 rpm; flow was too high.
- **4/15/02:** Quarterly sampling event. No samples taken at FSC-4 (pump off).
- **4/17/02:** Tracer study completed for FSC-2 and FSC-4.
- **4/22/02:** Removed all stop logs from STA-2 seepage canal Agri-drain.
- **4/30/02:** Pumps at all cells turned off because of insufficient water supply; cells begin dryout mode.

APPENDIX B-1

Estimated Water Balance from the Field-Scale PSTA Cells, August 2001 - April 2002

Cell	Freq	Time Period	Rainfall		ET		Inflow <sup>a</sup>		Outflow		Chng Storage (m <sup>3</sup> )	Residual	
			(in)	(m <sup>3</sup> )	(mm)	(m <sup>3</sup> )	(m <sup>3</sup> /d)	(m <sup>3</sup> )	(m <sup>3</sup> /d)	(m <sup>3</sup> )		(m <sup>3</sup> )	(% of Inflow)
FSC-1	Weekly	7/29/01	3.9	1,999	9.2	185	2,530	17,710	--	--	--	--	--
	Weekly	8/5/01	0.1	62	28.8	582	1,084	7,590	4,595	32,166	-9,941	-15,156	-198.1
	Weekly	8/12/01	0.0	0	35.1	711	723	5,060	0	0	3,922	427	8.4
	Weekly	8/19/01	0.6	293	32.7	662	1,084	7,590	110	773	4,626	1,823	23.1
	Weekly	8/26/01	0.2	103	29.9	605	2,530	17,710	1,276	8,934	-221	8,495	47.7
	Weekly	9/2/01	4.4	2,246	23.0	465	723	5,060	268	1,875	-2,436	7,402	101.3
	Weekly	9/9/01	3.7	1,881	18.7	378	0	0	347	2,426	298	-1,221	-64.9
	Weekly	9/16/01	0.9	447	31.4	635	1,084	7,590	65	453	2,210	4,739	59.0
	Weekly	9/23/01	5.5	2,847	19.1	386	0	0	94	661	-2,251	4,052	142.3
	Weekly	9/30/01	0.6	319	27.7	560	1,084	7,590	346	2,419	2,714	2,216	28.0
	Weekly	10/7/01	0.2	93	26.9	545	1,446	10,120	807	5,646	-2,935	6,956	68.1
	Weekly	10/14/01	0.6	329	17.4	352	1,446	10,120	332	2,321	2,755	5,021	48.1
	Weekly	10/21/01	2.7	1,367	17.2	348	2,169	15,180	1,324	9,265	-1,429	8,363	50.5
	Weekly	10/28/01	0.3	175	18.1	367	0	0	0	0	-2,457	2,264	1295.8
	Weekly	11/4/01	1.2	591	18.5	374	0	0	59	414	-3,361	3,164	535.3
	Weekly	11/11/01	0.0	0	18.9	382	1,454	10,178	334	2,338	1,629	5,829	57.3
	Weekly	11/18/01	0.0	0	20.7	419	0	0	0	0	-3,485	3,065	--
	Weekly	11/25/01	0.1	26	21.3	431	366	2,560	0	0	123	2,032	78.6
	Weekly	12/2/01	0.6	314	18.3	371	0	0	0	0	-1,711	1,654	527.6
	Weekly	12/9/01	0.0	21	18.1	367	816	5,711	0	0	2,858	2,507	43.7
	Weekly	12/16/01	0.0	0	18.7	378	1,784	12,489	162	1,132	3,885	7,093	56.8
	Weekly	12/23/01	0.5	236	15.7	318	278	1,948	89	625	-3,479	4,721	216.1
	Weekly	12/30/01	1.5	776	13.4	271	668	4,676	0	0	2,477	2,703	49.6
	Weekly	1/6/02	0.1	62	21.6	437	2,471	17,295	825	5,773	1,290	9,857	56.8
	Weekly	1/13/02	0.2	118	15.5	314	2,692	18,844	1,254	8,777	262	9,610	50.7
	Weekly	1/20/02	0.0	0	23.6	478	2,591	18,135	1,290	9,028	-283	8,912	49.1
	Weekly	1/27/02	0.0	0	19.8	400	2,108	14,757	805	5,638	-139	8,858	60.0
	Weekly	2/3/02	0.1	57	12.4	250	2,422	16,954	1,044	7,310	581	8,870	52.1
	Weekly	2/10/02	3.6	1,840	13.3	268	2,708	18,953	1,643	11,500	401	8,624	41.5
	Weekly	2/17/02	1.1	560	17.0	344	2,801	19,609	1,711	11,975	-159	8,009	39.7
	Weekly	2/24/02	0.0	5	23.9	484	2,869	20,086	1,720	12,039	-242	7,809	38.9
	Weekly	3/3/02	0.4	200	23.0	465	2,515	17,608	1,406	9,842	-98	7,599	42.7
	Weekly	3/10/02	0.0	21	32.0	647	2,366	16,565	1,208	8,455	-41	7,525	45.4
	Weekly	3/17/02	0.0	0	33.1	670	1,969	13,780	997	6,982	-1,768	7,896	57.3
	Weekly	3/24/02	0.0	21	35.3	715	1,873	13,113	546	3,819	1,691	6,909	52.6
	Weekly	3/31/02	0.0	5	32.5	658	2,166	15,160	979	6,852	-242	7,897	52.1
	Weekly	4/7/02	0.0	10	35.3	715	1,827	12,792	632	4,427	159	7,502	58.6
	Weekly	4/14/02	2.0	1,002	29.2	590	2,061	14,427	986	6,900	-41	7,980	51.7
	Weekly	4/21/02	0.0	0	40.9	828	1,952	13,663	733	5,131	-159	7,864	57.6
	Weekly	4/28/02	0.0	0	42.1	851	433	1,300	177	530	-2,220	2,138	164.6
FSC-2	Weekly	7/29/01	3.9	1,999	9.2	185	3,373	23,611	--	--	--	--	--
	Weekly	8/5/01	0.1	62	28.8	582	1,446	10,119	237	1,656	-5,061	13,003	127.7
	Weekly	8/12/01	0.0	0	35.1	711	0	0	0	0	-1,022	311	--
	Weekly	8/19/01	0.6	293	32.7	662	0	0	0	0	334	-703	-239.9
	Weekly	8/26/01	0.2	103	29.9	605	1,927	13,492	39	272	8,285	4,433	32.6
	Weekly	9/2/01	4.4	2,246	23.0	465	964	6,746	375	2,628	-2,256	8,155	90.7
	Weekly	9/9/01	3.7	1,881	18.7	378	0	0	0	0	-1,208	2,711	144.1
	Weekly	9/16/01	0.9	447	31.4	635	1,927	13,492	558	3,906	4,672	4,726	33.9
	Weekly	9/23/01	5.5	2,847	19.1	386	3,373	23,611	2,743	19,201	36	6,836	25.8
	Weekly	9/30/01	0.6	319	27.7	560	3,373	23,611	2,589	18,126	-123	5,367	22.4
	Weekly	10/7/01	0.2	93	26.9	545	3,373	23,611	2,305	16,136	-766	7,788	32.9
	Weekly	10/14/01	0.6	329	17.4	352	3,373	23,611	1,990	13,927	524	9,137	38.2
	Weekly	10/21/01	2.7	1,367	17.2	348	3,373	23,611	2,478	17,349	-987	8,268	33.1
	Weekly	10/28/01	0.3	175	18.1	367	3,373	23,611	1,186	8,301	704	14,414	60.6
	Weekly	11/4/01	1.2	591	18.5	374	2,971	20,795	2,264	15,846	-483	5,649	26.4
	Weekly	11/11/01	0.0	0	18.9	382	3,268	22,874	1,846	12,924	-303	9,872	43.2
	Weekly	11/18/01	0.0	0	20.7	419	258	1,808	176	1,233	-5,674	5,829	322.4
	Weekly	11/25/01	0.1	26	21.3	431	625	4,373	0	0	262	3,706	84.2
	Weekly	12/2/01	0.6	314	18.3	371	6	43	0	0	-2,731	2,717	762.4
	Weekly	12/9/01	0.0	21	18.1	367	2,673	18,708	385	2,693	7,890	7,779	41.5
	Weekly	12/16/01	0.0	0	18.7	378	3,207	22,446	1,253	8,773	421	12,873	57.4
	Weekly	12/23/01	0.5	236	15.7	318	3,412	23,884	1,688	11,813	180	11,810	49.0
	Weekly	12/30/01	1.5	776	13.4	271	2,323	16,259	994	6,958	-200	10,006	58.7
	Weekly	1/6/02	0.1	62	21.6	437	1,165	8,158	748	5,236	-3,058	5,605	68.2
	Weekly	1/13/02	0.2	118	15.5	314	2,006	14,042	656	4,592	3,120	6,135	43.3
	Weekly	1/20/02	0.0	0	23.6	478	3,254	22,780	1,648	11,539	-144	10,907	47.9
	Weekly	1/27/02	0.0	0	19.8	400	2,864	20,047	1,188	8,314	-242	11,575	57.7
	Weekly	2/3/02	0.1	57	12.4	250	2,730	19,111	1,003	7,023	62	11,833	61.7
	Weekly	2/10/02	3.6	1,840	13.3	268	2,904	20,325	1,306	9,142	504	12,251	55.3
	Weekly	2/17/02	1.1	560	17.0	344	3,062	21,435	1,465	10,255	-200	11,597	52.7

APPENDIX B-1

Estimated Water Balance from the Field-Scale PSTA Cells, August 2001 - April 2002

Cell	Freq	Time Period	Rainfall		ET		Inflow <sup>a</sup>		Outflow		Chng Storage (m <sup>3</sup> )	Residual		
			(in)	(m <sup>3</sup> )	(mm)	(m <sup>3</sup> )	(m <sup>3</sup> /d)	(m <sup>3</sup> )	(m <sup>3</sup> /d)	(m <sup>3</sup> )		(m <sup>3</sup> )	(% of Inflow)	(cm/d)
Weekly		2/24/02	0.0	5	23.9	484	3,067	21,470	1,461	10,228	0	10,763	50.1	7.6
Weekly		3/3/02	0.4	200	23.0	465	2,977	20,841	1,543	10,798	21	9,758	46.4	6.9
Weekly		3/10/02	0.0	21	32.0	647	3,081	21,565	1,471	10,298	-144	10,785	50.0	7.6
Weekly		3/17/02	0.0	0	33.1	670	3,016	21,112	1,333	9,334	-159	11,268	53.4	8.0
Weekly		3/24/02	0.0	21	35.3	715	3,058	21,403	1,333	9,334	303	11,072	51.7	7.8
Weekly		3/31/02	0.0	5	32.5	658	3,282	22,975	1,693	11,852	-62	10,532	45.8	7.4
Weekly		4/7/02	0.0	10	35.3	715	3,195	22,363	1,747	12,230	139	9,290	41.5	6.6
Weekly		4/14/02	2.0	1,002	29.2	590	3,017	21,120	1,764	12,351	-118	9,299	42.0	6.6
Weekly		4/21/02	0.0	0	40.9	828	2,504	17,531	1,413	9,889	-139	6,953	39.7	4.9
Weekly		4/28/02	0.0	0	42.1	851	753	2,258	470	1,411	-2,159	2,155	95.4	3.5
FSC-3	Weekly	7/29/01	3.9	1,999	9.2	185	3,121	21,847	--	--	--	--	--	--
Weekly		8/5/01	0.1	62	28.8	582	1,338	9,363	6,176	43,234	-7,807	-26,585	-282.1	-18.8
Weekly		8/12/01	0.0	0	35.1	711	446	3,121	510	3,569	925	-2,084	-66.8	-1.5
Weekly		8/19/01	0.6	293	32.7	662	2,229	15,605	727	5,089	5,895	4,253	26.7	3.0
Weekly		8/26/01	0.2	103	29.9	605	3,121	21,847	2,856	19,994	-905	2,255	10.3	1.6
Weekly		9/2/01	4.4	2,246	23.0	465	446	3,121	357	2,501	-869	3,269	60.9	2.3
Weekly		9/9/01	3.7	1,881	18.7	378	2,229	15,605	3,109	21,760	1,650	-6,302	-36.0	-4.4
Weekly		9/16/01	0.9	447	31.4	635	1,338	9,363	2,246	15,722	-2,395	-4,152	-42.3	-2.9
Weekly		9/23/01	5.5	2,847	19.1	386	2,675	18,726	2,535	17,748	2,595	844	3.9	0.6
Weekly		9/30/01	0.6	319	27.7	560	2,229	15,605	3,279	22,951	-2,452	-5,136	-32.3	-3.6
Weekly		10/7/01	0.2	93	26.9	545	2,229	15,605	2,972	20,802	2,210	-7,859	-50.1	-5.5
Weekly		10/14/01	0.6	329	17.4	352	2,675	18,726	2,929	20,502	-843	-956	-5.0	-0.7
Weekly		10/21/01	2.7	1,367	17.2	348	1,338	9,363	1,533	10,729	463	-810	-7.5	-0.6
Weekly		10/28/01	0.3	175	18.1	367	3,121	21,847	3,523	24,659	725	-3,729	-16.9	-2.6
Weekly		11/4/01	1.2	591	18.5	374	2,559	17,913	3,631	25,415	-41	-7,244	-39.1	-5.1
Weekly		11/11/01	0.0	0	18.9	382	1,415	9,908	2,186	15,301	21	-5,795	-58.5	-4.1
Weekly		11/18/01	0.0	0	20.7	419	584	4,090	3,118	21,827	98	-18,254	-446.3	-12.9
Weekly		11/25/01	0.1	26	21.3	431	2	13	1,894	13,255	-2,416	-11,232	-29127.1	-7.9
Weekly		12/2/01	0.6	314	18.3	371	0	3	0	0	-1,002	948	299.3	0.7
Weekly		12/9/01	0.0	21	18.1	367	645	4,517	700	4,901	1,526	-2,257	-49.7	-1.6
Weekly		12/16/01	0.0	0	18.7	378	688	4,816	592	4,145	-41	334	6.9	0.2
Weekly		12/23/01	0.5	236	15.7	318	370	2,593	280	1,957	586	-31	-1.1	0.0
Weekly		12/30/01	1.5	776	13.4	271	599	4,191	783	5,479	-41	-742	-14.9	-0.5
Weekly		1/6/02	0.1	62	21.6	437	524	3,670	460	3,220	-278	353	9.4	0.2
Weekly		1/13/02	0.2	118	15.5	314	125	873	206	1,445	-319	-449	-45.3	-0.3
Weekly		1/20/02	0.0	0	23.6	478	171	1,200	177	1,238	319	-835	-69.6	-0.6
Weekly		1/27/02	0.0	0	19.8	400	482	3,377	932	6,523	704	-4,250	-125.9	-3.0
Weekly		2/3/02	0.1	57	12.4	250	310	2,167	1,076	7,529	139	-5,695	-256.2	-4.0
Weekly		2/10/02	3.6	1,840	13.3	268	1,034	7,236	1,777	12,440	1,028	-4,661	-51.4	-3.3
Weekly		2/17/02	1.1	560	17.0	344	1,917	13,417	2,343	16,399	-221	-2,545	-18.2	-1.8
Weekly		2/24/02	0.0	5	23.9	484	1,460	10,218	2,356	16,493	-905	-5,850	-57.2	-4.1
Weekly		3/3/02	0.4	200	23.0	465	368	2,573	1,140	7,982	-684	-4,990	-180.0	-3.5
Weekly		3/10/02	0.0	21	32.0	647	372	2,607	1,436	10,055	905	-8,979	-341.8	-6.3
Weekly		3/17/02	0.0	0	33.1	670	547	3,829	2,437	17,056	642	-14,539	-379.7	-10.3
Weekly		3/24/02	0.0	21	35.3	715	575	4,028	2,074	14,521	-1,326	-9,862	-243.6	-7.0
Weekly		3/31/02	0.0	5	32.5	658	81	569	82	573	-745	88	15.4	0.1
Weekly		4/7/02	0.0	10	35.3	715	358	2,509	1,900	13,302	2,272	-13,769	-546.7	-9.7
Weekly		4/14/02	2.0	1,002	29.2	590	985	6,893	3,320	23,240	-324	-15,611	-197.7	-11.0
Weekly		4/21/02	0.0	0	40.9	828	284	1,988	1,429	10,004	-1,064	-7,780	-391.3	-5.5
Weekly		4/28/02	0.0	0	42.1	851	424	1,271	687	2,062	-740	-902	-71.0	-1.5
FSC-4	Weekly	7/29/01	3.9	1,999	9.2	185	0	0	--	--	--	--	--	--
Weekly		8/5/01	0.1	62	28.8	582	0	0	0	0	-1,260	740	1199.1	0.5
Weekly		8/12/01	0.0	0	35.1	711	0	0	0	0	-454	-256	--	-0.2
Weekly		8/19/01	0.6	293	32.7	662	0	0	0	0	108	-477	-162.7	-0.3
Weekly		8/26/01	0.2	103	29.9	605	0	0	0	0	11	-514	-499.8	-0.4
Weekly		9/2/01	4.4	2,246	23.0	465	0	0	0	0	6,878	-5,097	-226.9	-3.6
Weekly		9/9/01	3.7	1,881	18.7	378	0	0	121	850	-144	797	42.4	0.6
Weekly		9/16/01	0.9	447	31.4	635	0	0	0	0	-4,384	4,196	938.4	3.0
Weekly		9/23/01	5.5	2,847	19.1	386	0	0	0	0	4,934	-2,472	-86.8	-1.7
Weekly		9/30/01	0.6	319	27.7	560	0	0	0	0	-1,331	1,090	342.1	0.8
Weekly		10/7/01	0.2	93	26.9	545	0	0	0	0	-966	514	555.4	0.4
Weekly		10/14/01	0.6	329	17.4	352	0	0	0	0	-3,370	3,348	1017.8	2.4
Weekly		10/21/01	2.7	1,367	17.2	348	0	0	0	0	1,781	-762	-55.8	-0.5
Weekly		10/28/01	0.3	175	18.1	367	0	0	0	0	-380	188	107.6	0.1
Weekly		11/4/01	1.2	591	18.5	374	1,628	11,396	0	0	-98	11,711	97.7	8.3
Weekly		11/11/01	0.0	0	18.9	382	1,539	10,776	0	0	-1,300	11,694	108.5	8.3
Weekly		11/18/01	0.0	0	20.7	419	1,381	9,666	0	0	1,791	7,456	77.1	5.3
Weekly		11/25/01	0.1	26	21.3	431	1,148	8,034	0	0	-2,975	10,603	131.6	7.5
Weekly		12/2/01	0.6	314	18.3	371	42	295	0	0	-592	830	136.3	0.6
Weekly		12/9/01	0.0	21	18.1	367	2,290	16,031	94	659	11,644	3,381	21.1	2.4

APPENDIX B-1

Estimated Water Balance from the Field-Scale PSTA Cells, August 2001 - April 2002

Cell	Freq	Time Period	Rainfall		ET		Inflow <sup>a</sup>		Outflow		Chng Storage (m <sup>3</sup> )	Residual		
			(in)	(m <sup>3</sup> )	(mm)	(m <sup>3</sup> )	(m <sup>3</sup> /d)	(m <sup>3</sup> )	(m <sup>3</sup> /d)	(m <sup>3</sup> )		(m <sup>3</sup> )	(% of Inflow)	(cm/d)
Weekly		12/16/01	0.0	0	18.7	378	3,200	22,400	1,355	9,482	41	12,499	55.8	8.8
Weekly		12/23/01	0.5	236	15.7	318	3,200	22,400	2,338	16,363	-2,318	8,274	36.6	5.8
Weekly		12/30/01	1.5	776	13.4	271	3,200	22,400	1,900	13,299	303	9,303	40.1	6.6
Weekly		1/6/02	0.1	62	21.6	437	3,082	21,575	1,167	8,171	-946	13,974	64.6	9.9
Weekly		1/13/02	0.2	118	15.5	314	2,944	20,611	801	5,604	-41	14,852	71.7	10.5
Weekly		1/20/02	0.0	0	23.6	478	2,469	17,286	535	3,744	-1,388	14,451	83.6	10.2
Weekly		1/27/02	0.0	0	19.8	400	821	5,749	0	0	-2,035	7,384	128.4	5.2
Weekly		2/3/02	0.1	57	12.4	250	1,210	8,472	0	0	2,277	6,002	70.4	4.2
Weekly		2/10/02	3.6	1,840	13.3	268	3,228	22,597	623	4,363	1,912	17,894	73.2	12.6
Weekly		2/17/02	1.1	560	17.0	344	3,263	22,843	939	6,573	-221	16,707	71.4	11.8
Weekly		2/24/02	0.0	5	23.9	484	2,810	19,670	558	3,908	-946	16,229	82.5	11.5
Weekly		3/3/02	0.4	200	23.0	465	2,224	15,569	76	534	139	14,632	92.8	10.3
Weekly		3/10/02	0.0	21	32.0	647	2,865	20,052	155	1,083	-118	18,461	92.0	13.0
Weekly		3/17/02	0.0	0	33.1	670	2,809	19,663	68	474	-421	18,940	96.3	13.4
Weekly		3/24/02	0.0	21	35.3	715	2,043	14,303	304	2,126	905	10,578	73.9	7.5
Weekly		3/31/02	0.0	5	32.5	658	3,209	22,465	1,107	7,746	519	13,547	60.3	9.6
Weekly		4/7/02	0.0	10	35.3	715	2,101	14,707	698	4,884	-4,507	13,626	92.6	9.6
Weekly		4/14/02	2.0	1,002	29.2	590	2,127	14,887	196	1,375	4,708	9,217	58.0	6.5
Weekly		4/21/02	0.0	0	40.9	828	1,857	13,000	291	2,034	-3,963	14,100	108.5	10.0
Weekly		4/28/02	0.0	0	42.1	851	0	0	0	0	-3,207	2,356	--	3.9

## APPENDIX B-2

Field Parameter Measurements from the Field-Scale PSTA Cells, August 2001 - April 2002

Cell	Frequency	Time Period	Temp C	pH units	Cond µmhos/cm	TDS g/L	DO SAT	DO mg/L
Inflow Canal	Weekly	8/5/01	28.57	7.30	983	0.63	42.2	3.30
		8/26/01	28.29	7.52	893	0.57	47.8	3.74
		9/2/01	29.30	7.81	917	0.59	38.3	2.96
		9/9/01	27.07	7.51	962	0.62	52.5	4.17
		9/16/01	30.72	7.77	1115	0.72	69.2	5.16
		9/23/01	28.27	7.48	1153	0.74	58.7	4.57
		9/30/01	24.84	7.53	1158	0.74	70.4	5.84
		10/7/01	25.55	7.54	1181	0.75	68.8	5.59
		10/14/01	26.10	7.79	1097	0.70	75.9	6.15
		10/21/01	26.90	7.64	1213	0.78	43.4	3.42
		10/28/01	20.82	7.75	1425	0.91	84.2	7.47
		11/4/01	21.38	7.69	1366	0.88	92.4	8.13
		11/11/01	21.74	8.04	1355	0.87	98.5	8.62
		11/18/01	22.39	7.99	1273	0.81	88.7	7.62
		11/25/01	22.27	7.71	1261	0.81	71.9	6.25
		12/9/01	25.23	7.79	1354	0.89	72.6	5.93
		12/16/01	22.32	7.64	1399	0.90	66.0	5.73
		12/23/01	15.85	7.96	1996	1.28	90.2	8.97
		12/30/01	18.66	7.87	1399	0.90	76.9	7.14
		1/6/02	13.77	7.89	1259	0.81	87.3	8.97
		1/13/02	20.86	7.65	1244	0.80	73.6	6.55
		1/20/02	24.25	7.77	1284	0.82	62.7	5.21
		1/27/02	24.23	7.42	1361	0.87	53.7	4.49
		2/3/02	20.51	7.51	1341	0.86	61.0	5.47
		2/17/02	18.78	8.03	1232	0.80	87.1	8.08
		2/24/02	20.58	7.99	1324	0.85	87.1	7.76
		3/3/02	15.42	8.06	1291	0.83	87.3	8.85
		3/10/02	24.49	7.99	1305	0.84	85.3	7.13
		3/17/02	26.21	7.96	1324	0.85	80.4	6.48
		3/24/02	26.47	8.01	1312	0.84	86.7	6.98
3/31/02	27.97	8.00	1295	0.83	77.0	6.01		
4/7/02	22.15	8.26	1344	0.86	83.5	7.24		
4/14/02	23.95	8.01	1344	0.86	63.4	5.30		
4/21/02	27.92	7.83	1350	0.86	72.1	5.63		
FSC-1	Weekly	8/5/01	30.84	8.26	904	0.58	110.8	8.21
		8/19/01	34.31	8.29	856	0.55	115.0	8.05
		8/26/01	31.18	8.22	898	0.57	91.5	6.73
		9/2/01	30.19	8.48	914	0.58	93.7	7.00
		9/9/01	27.13	8.56	750	0.48	101.0	7.98
		9/16/01	29.88	8.55	849	0.54	122.0	9.13
		9/23/01	28.13	8.40	953	0.61	113.2	8.78
		9/30/01	26.83	8.52	866	0.55	116.9	9.25
		10/7/01	27.21	8.31	1068	0.68	114.4	9.02
		10/14/01	26.77	8.34	1027	0.66	107.0	8.49
		10/21/01	26.18	8.19	1092	0.70	108.7	8.74
		10/28/01	20.61	8.58	1137	0.73	101.1	9.04
		11/4/01	22.59	8.46	1184	0.76	126.6	10.85
		11/11/01	22.26	8.41	1182	0.76	118.7	10.25
		11/18/01	22.85	8.46	1153	0.60	116.4	9.93
		11/25/01	22.18	8.23	1221	0.06	117.5	10.42
		12/9/01	24.25	8.18	1278	0.82	102.1	8.43
		12/16/01	20.93	8.18	1319	0.84	110.5	9.77
		12/23/01	18.75	8.32	1279	0.82	116.5	10.78
		12/30/01	18.86	8.31	1180	0.76	102.2	9.41
1/6/02	17.31	8.17	1237	0.79	118.4	11.27		

## APPENDIX B-2

Field Parameter Measurements from the Field-Scale PSTA Cells, August 2001 - April 2002

Cell	Frequency	Time Period	Temp C	pH units	Cond µmhos/cm	TDS g/L	DO SAT	DO mg/L
		1/13/02	20.21	8.05	1219	0.78	96.3	8.67
		1/20/02	24.54	8.13	1292	0.83	119.1	9.82
		1/27/02	24.56	7.99	1353	0.87	98.2	8.08
		2/3/02	21.82	8.13	1290	0.83	101.5	8.83
		2/10/02	22.52	8.04	1256	0.80	98.8	8.45
		2/17/02	22.25	8.12	1162	0.74	95.4	8.24
		2/24/02	20.60	8.18	1196	0.77	114.2	10.16
		3/3/02	20.03	8.11	1250	0.80	109.0	9.80
		3/10/02	24.32	7.99	1266	0.81	104.9	8.68
		3/17/02	25.98	8.13	1219	0.78	67.9	5.43
		3/24/02	25.65	8.23	1221	0.78	52.3	4.21
		3/31/02	27.01	8.28	1463	0.94	124.4	9.86
		4/7/02	22.35	8.49	1452	0.93	123.5	10.63
		4/14/02	26.63	8.32	1290	0.83	134.0	10.63
		4/21/02	28.52	8.26	1310	0.84	120.6	9.19
FSC-2	Weekly	8/26/01	28.42	7.76	958	0.61	51.6	4.03
		9/2/01	29.07	7.99	919	0.59	50.6	3.94
		9/9/01	25.99	7.83	665	0.43	45.8	3.69
		9/16/01	27.66	7.98	830	0.53	60.6	4.71
		9/23/01	25.71	7.86	1123	0.72	91.4	7.44
		9/30/01	26.55	7.98	1147	0.73	119.4	9.47
		10/7/01	27.46	8.04	1158	0.74	104.5	8.17
		10/14/01	25.97	7.90	1083	0.69	90.8	7.35
		10/21/01	26.36	7.92	1178	0.75	72.9	6.03
		10/28/01	21.00	7.97	1362	0.87	86.1	7.64
		11/4/01	21.90	8.16	1616	1.03	127.3	11.04
		11/11/01	21.45	8.01	1337	0.86	96.4	8.48
		11/18/01	21.83	7.86	1269	0.81	64.2	5.60
		11/25/01	21.36	7.83	1294	0.83	90.7	6.32
		12/9/01	25.19	7.84	1325	0.85	79.5	6.55
		12/16/01	21.94	7.67	1387	0.89	71.0	6.21
		12/23/01	14.62	8.02	1963	1.26	92.4	9.45
		12/30/01	13.71	8.23	1229	0.79	126.1	12.94
		1/6/02	14.92	8.08	1264	0.81	118.5	11.92
		1/13/02	23.24	8.16	1133	0.73	176.6	16.17
		1/20/02	24.47	8.09	1042	0.67	173.2	15.56
		1/27/02	25.10	7.92	1312	0.84	109.4	8.92
		2/3/02	21.46	8.01	1304	0.83	110.4	9.67
		2/10/02	21.18	8.02	1081	0.69	108.2	9.53
		2/17/02	20.47	8.18	1097	0.70	121.4	10.84
		2/24/02	18.58	8.13	1272	0.81	128.9	11.99
		3/3/02	20.73	8.11	1266	0.82	112.8	10.04
		3/10/02	26.23	8.14	1266	0.81	122.6	9.77
		3/17/02	26.11	8.13	1265	0.81	107.0	8.52
		3/24/02	27.26	8.20	1260	0.81	69.3	5.40
		3/31/02	26.70	8.24	1254	0.80	56.9	4.48
		4/7/02	24.86	8.31	1336	0.86	110.1	9.01
		4/14/02	24.13	8.17	1321	0.85	90.7	7.55
		4/21/02	27.46	7.98	1340	0.86	71.9	5.66
FSC-3	Weekly	7/29/01	26.55	8.09	313	0.20	90.5	7.27
		8/5/01	29.77	7.89	701	0.45	100.4	7.57
		8/19/01	34.52	7.65	990	0.63	105.1	7.33
		8/26/01	31.10	7.81	988	0.63	95.3	7.02
		9/2/01	30.09	8.06	941	0.60	89.6	6.71
		9/9/01	27.29	8.25	811	0.52	91.9	7.25

APPENDIX B-2

Field Parameter Measurements from the Field-Scale PSTA Cells, August 2001 - April 2002

Cell	Frequency	Time Period	Temp C	pH units	Cond µmhos/cm	TDS g/L	DO SAT	DO mg/L
		9/16/01	29.65	8.14	1079	0.69	105.2	7.94
		9/23/01	29.83	7.91	1093	0.70	97.4	7.33
		9/30/01	25.00	7.42	1132	0.72	89.0	7.34
		10/7/01	25.14	8.03	1099	0.70	75.9	6.24
		10/14/01	25.90	7.87	1086	0.69	82.9	6.79
		10/21/01	26.05	7.95	1082	0.69	78.2	6.31
		10/28/01	21.34	8.01	1369	0.87	97.5	8.44
		11/4/01	21.23	7.99	1319	0.84	94.5	8.31
		11/11/01	21.44	7.91	1326	0.85	96.0	8.46
		11/18/01	22.22	8.12	1270	0.81	90.2	7.85
		11/25/01	22.62	7.98	1255	0.80	90.5	7.79
		12/9/01	25.61	7.87	1284	0.82	87.5	7.11
		12/16/01	21.97	7.90	1335	0.85	76.2	6.66
		12/23/01	14.29	8.26	1912	1.23	91.2	9.31
		12/30/01	18.70	8.03	1282	0.82	76.1	7.06
		1/6/02	12.76	8.05	1215	0.78	85.1	9.03
		1/13/02	20.70	7.98	1211	0.78	87.1	7.55
		1/20/02	24.63	8.32	1177	0.75	104.2	8.61
		1/27/02	25.03	8.24	1271	0.81	103.7	8.50
		2/3/02	21.30	8.26	1314	0.84	98.8	8.70
		2/10/02	21.00	8.13	1149	0.74	95.5	8.46
		2/17/02	20.34	8.17	1082	0.69	96.7	8.69
		2/24/02	18.49	8.16	1251	0.80	111.5	10.41
		3/3/02	20.86	8.14	1251	0.80	105.4	9.39
		3/10/02	26.14	8.24	1246	0.80	113.6	9.12
		3/17/02	26.12	8.25	1250	0.80	105.2	8.43
		3/24/02	27.04	8.14	1265	0.81	100.2	7.90
		3/31/02	26.20	8.23	1333	0.85	91.1	7.29
		4/7/02	24.75	8.36	1353	0.87	102.3	8.41
		4/14/02	26.11	8.17	1288	0.82	81.8	6.57
		4/21/02	28.50	8.17	1327	0.85	73.1	5.60
FSC-4	Weekly	9/2/01	28.30	7.78	927	0.59	36.2	2.85
		9/9/01	26.93	7.53	810	0.52	65.2	5.14
		9/16/01	29.21	7.48	1030	0.66	50.8	3.74
		9/23/01	26.81	7.52	1034	0.66	58.4	4.56
		9/30/01	27.01	7.64	1053	0.67	67.5	5.24
		10/7/01	27.22	7.67	1115	0.71	70.1	5.39
		10/14/01	26.01	7.57	1021	0.64	60.8	4.75
		10/28/01	22.10	7.68	1337	0.86	83.5	7.06
		11/4/01	23.14	7.80	1245	0.80	89.5	7.96
		11/11/01	21.49	7.58	1310	0.84	75.2	7.01
		11/18/01	22.99	8.17	1258	0.81	93.2	7.99
		11/25/01	21.93	7.60	1220	0.75	76.2	6.41
		12/9/01	24.79	7.73	1327	0.86	72.6	5.95
		12/16/01	23.95	7.79	1350	0.86	72.2	6.03
		12/23/01	14.96	7.74	1957	1.25	81.9	8.37
		12/30/01	18.59	7.76	1343	0.86	70.2	6.56
		1/6/02	13.14	7.71	1256	0.80	74.6	7.81
		1/13/02	22.56	7.59	1224	0.79	71.6	6.37
		1/20/02	24.51	7.63	1308	0.82	53.2	4.35
		1/27/02	24.20	7.55	1374	0.88	49.6	4.01
		2/3/02	21.89	7.72	1319	0.84	73.4	6.27
		2/10/02	22.55	7.69	1281	0.82	67.3	5.74
		2/17/02	22.02	7.95	1209	0.75	77.7	6.74
		2/24/02	20.15	8.02	1246	0.80	90.4	8.10

**APPENDIX B-2**

Field Parameter Measurements from the Field-Scale PSTA Cells, August 2001 - April 2002

<b>Cell</b>	<b>Frequency</b>	<b>Time Period</b>	<b>Temp C</b>	<b>pH units</b>	<b>Cond µmhos/cm</b>	<b>TDS g/L</b>	<b>DO SAT</b>	<b>DO mg/L</b>
		3/3/02	20.28	7.87	1251	0.80	101.4	9.07
		3/10/02	24.54	7.76	1241	0.79	82.0	6.72
		3/17/02	25.78	7.89	1273	0.81	82.9	6.63
		3/24/02	25.45	7.86	1272	0.81	66.4	5.32
		3/31/02	26.82	7.75	1283	0.82	69.2	5.41
		4/7/02	22.18	8.00	1321	0.85	75.8	6.51
		4/21/02	27.38	7.63	1353	0.87	66.8	5.27

Note:

FSC 1-4 averages include inflow, center, and outflow stations

APPENDIX B-3

Phosphorus Water Quality Data from the Field-Scale PSTA Cells, August 2001 - April 2002

Cell	Freq	Time Period	TP mg/L				TDP mg/L				SRP mg/L				TPP mg/L				DOP mg/L			
			InfCnl	Inflow	stn_1/2	Outflow	InfCnl	Inflow	stn_1/2	Outflow	InfCnl	Inflow	stn_1/2	Outflow	InfCnl	Inflow	stn_1/2	Outflow	InfCnl	Inflow	stn_1/2	Outflow
FSC-1	Weekly	8/5/01	0.017	--	--	0.013	0.006	--	--	0.004	0.003	--	--	0.001	0.009	--	--	0.009	0.003	--	--	0.003
		8/26/01	0.022	0.024	0.019	0.025	0.010	0.009	0.008	0.007	0.002	0.001	0.001	0.001	0.013	0.015	0.011	0.014	0.008	0.008	0.007	0.006
		9/2/01	0.022	--	--	0.028	0.009	--	--	0.010	0.001	--	--	0.004	0.016	--	--	0.030	0.008	--	--	0.006
		9/9/01	0.021	--	--	0.014	0.007	--	--	0.006	0.004	--	--	0.001	0.011	--	--	0.008	0.003	--	--	0.005
		10/7/01	0.016	--	--	0.014	0.008	--	--	0.006	0.004	--	--	0.002	0.007	--	--	0.007	0.004	--	--	0.004
		10/14/01	0.018	--	--	0.015	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		10/21/01	0.015	0.026	0.015	0.015	0.007	0.012	0.007	0.006	0.013	0.003	0.003	0.003	0.007	0.015	0.008	0.009	0.000	0.009	0.004	0.003
		11/4/01	0.013	--	--	0.023	0.007	--	--	0.008	0.002	--	--	0.002	0.006	--	--	0.015	0.005	--	--	0.006
		11/11/01	0.010	--	--	0.017	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		11/25/01	0.015	0.017	--	--	0.007	0.007	--	--	0.002	0.001	--	--	0.008	0.010	--	--	0.005	0.006	--	--
		12/16/01	0.015	0.021	--	0.045	0.008	0.009	--	--	0.001	0.001	--	--	0.008	0.012	--	--	0.007	0.008	--	--
		1/6/02	0.011	--	--	0.017	0.005	--	--	0.006	0.002	--	--	0.001	0.005	--	--	0.013	0.003	--	--	0.005
		1/13/02	0.012	--	--	0.020	0.005	--	--	0.006	0.002	--	--	0.002	0.005	--	--	0.014	0.003	--	--	0.005
		1/20/02	0.016	0.022	0.017	0.018	0.007	0.008	0.007	0.006	0.001	0.001	0.001	0.001	0.009	0.014	0.010	0.013	0.006	0.007	0.006	0.005
		1/27/02	0.015	--	--	0.018	0.005	--	--	0.008	0.002	--	--	0.002	0.010	--	--	0.010	0.003	--	--	0.006
		2/3/02	0.015	--	--	0.023	0.005	--	--	0.007	0.003	--	--	0.001	0.010	--	--	0.013	0.002	--	--	0.006
		2/10/02	0.020	--	--	0.018	0.014	--	--	0.008	0.005	--	--	0.000	0.001	--	--	0.010	0.009	--	--	0.008
		2/17/02	0.022	--	--	0.016	0.011	--	--	0.008	0.002	--	--	0.001	0.015	--	--	0.010	0.009	--	--	0.007
		2/24/02	0.016	0.016	0.014	0.014	0.009	0.008	0.007	0.006	0.003	0.002	0.002	0.001	0.007	0.008	0.007	0.008	0.006	0.006	0.005	0.005
		3/3/02	0.017	--	--	0.016	0.006	--	--	0.006	0.004	--	--	0.003	0.011	--	--	0.010	0.002	--	--	0.003
		3/10/02	0.027	--	--	0.017	0.016	--	--	0.007	0.005	--	--	0.004	0.011	--	--	0.010	0.011	--	--	0.003
		3/17/02	0.047	--	--	0.019	0.012	--	--	0.009	0.002	--	--	0.004	0.035	--	--	0.010	0.010	--	--	0.005
		3/24/02	0.060	0.025	--	--	0.010	0.010	--	--	0.003	0.007	--	--	0.050	0.015	--	--	0.007	0.003	--	--
		3/31/02	0.046	--	--	0.028	0.012	--	--	0.011	0.002	--	--	0.002	0.034	--	--	0.017	0.010	--	--	0.009
4/7/02	0.022	--	--	0.024	0.011	--	--	0.009	0.002	--	--	0.001	0.011	--	--	0.015	0.009	--	--	0.008		
4/14/02	0.051	0.025	0.021	0.047	0.012	0.012	0.010	0.010	0.003	0.001	0.005	0.001	0.039	0.013	0.011	0.037	0.009	0.011	0.005	0.009		
4/21/02	0.064	--	--	0.021	0.008	--	--	0.008	0.005	--	--	0.005	0.056	--	--	0.013	0.003	--	--	0.003		
FSC-2	Weekly	9/2/01	0.022	--	--	0.020	0.009	--	--	0.010	0.001	--	--	0.002	0.016	--	--	0.011	0.008	--	--	0.008
		9/16/01	0.025	--	--	0.018	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		9/23/01	0.019	0.018	0.015	0.015	0.007	0.007	0.007	0.007	0.003	0.003	0.003	0.004	0.010	0.011	0.008	0.009	0.004	0.005	0.004	0.003
		9/30/01	0.015	--	--	0.010	0.006	--	--	0.006	0.011	--	--	0.002	0.008	--	--	0.005	0.000	--	--	0.004
		10/7/01	0.016	--	--	0.013	0.008	--	--	0.008	0.004	--	--	0.002	0.007	--	--	0.004	0.004	--	--	0.006
		10/14/01	0.017	--	--	0.013	0.009	--	--	0.039	0.002	--	--	0.001	0.007	--	--	0.000	0.007	--	--	0.038
		10/21/01	0.015	0.026	0.014	0.014	0.007	0.009	0.008	0.008	0.013	0.003	0.003	0.003	0.007	0.017	0.006	0.006	0.000	0.006	0.005	0.005
		10/28/01	0.016	--	--	0.011	0.007	--	--	0.006	0.001	--	--	0.001	0.004	--	--	0.006	0.006	--	--	0.005
		11/4/01	0.014	--	--	0.012	0.007	--	--	0.007	0.002	--	--	0.003	0.006	--	--	0.005	0.005	--	--	0.004
		11/11/01	0.010	--	--	0.010	0.005	--	--	0.005	0.001	--	--	0.001	0.005	--	--	0.005	0.004	--	--	0.004
		11/25/01	0.015	0.017	--	--	0.007	0.007	--	--	0.002	0.002	--	--	0.008	0.010	--	--	0.005	0.005	--	--
		12/9/01	0.018	--	--	0.036	0.011	--	--	0.018	0.002	--	--	0.004	0.007	--	--	0.018	0.009	--	--	0.014
		12/16/01	0.015	0.020	0.017	0.018	0.008	0.009	0.009	0.010	0.001	0.002	0.001	0.001	0.008	0.011	0.008	0.010	0.007	0.007	0.008	0.009
		12/23/01	0.014	--	--	0.016	0.007	--	--	0.015	--	--	--	--	0.007	--	--	0.001	--	--	--	--
		1/6/02	0.010	--	--	0.013	0.005	--	--	0.006	0.002	--	--	0.002	0.005	--	--	0.007	0.003	--	--	0.004
		1/13/02	0.012	--	--	0.013	0.005	--	--	0.005	0.002	--	--	0.002	0.005	--	--	0.010	0.003	--	--	0.003
		1/20/02	0.016	0.019	0.014	0.017	0.007	0.006	0.006	0.006	0.001	0.002	0.001	0.001	0.009	0.013	0.008	0.012	0.006	0.004	0.005	0.005
		1/27/02	0.015	--	--	0.015	0.005	--	--	0.006	0.002	--	--	0.002	0.010	--	--	0.009	0.003	--	--	0.004
		2/3/02	0.015	--	--	0.013	0.005	--	--	0.007	0.003	--	--	0.002	0.010	--	--	0.006	0.002	--	--	0.005
		2/10/02	0.020	--	--	0.015	0.014	--	--	0.006	0.005	--	--	0.001	0.001	--	--	0.008	0.009	--	--	0.005
		2/17/02	0.022	--	--	0.017	0.011	--	--	0.008	0.002	--	--	0.001	0.015	--	--	0.013	0.009	--	--	0.007

APPENDIX B-3

Phosphorus Water Quality Data from the Field-Scale PSTA Cells, August 2001 - April 2002

Cell	Freq	Time Period	TP mg/L				TDP mg/L				SRP mg/L				TPP mg/L				DOP mg/L			
			InfCnl	Inflow	stn_1/2	Outflow	InfCnl	Inflow	stn_1/2	Outflow	InfCnl	Inflow	stn_1/2	Outflow	InfCnl	Inflow	stn_1/2	Outflow	InfCnl	Inflow	stn_1/2	Outflow
		2/24/02	0.016	0.019	0.012	0.012	0.009	0.008	0.008	0.006	0.003	0.003	0.001	0.003	0.007	0.011	0.004	0.006	0.006	0.005	0.007	0.003
		3/3/02	0.017	--	--	0.019	0.006	--	--	0.008	0.004	--	--	0.004	0.011	--	--	0.012	0.002	--	--	0.004
		3/10/02	0.027	--	--	0.014	0.016	--	--	0.009	0.005	--	--	0.001	0.011	--	--	0.005	0.011	--	--	0.008
		3/17/02	0.047	--	--	0.016	0.012	--	--	0.009	0.002	--	--	0.004	0.035	--	--	0.007	0.010	--	--	0.005
		3/24/02	0.060	0.023	0.017	0.016	0.010	0.010	0.016	0.012	0.003	0.008	0.009	0.001	0.050	0.013	0.001	0.004	0.007	0.002	0.007	0.011
		3/31/02	0.046	--	--	0.018	0.012	--	--	0.010	0.002	--	--	0.013	0.034	--	--	0.008	0.010	--	--	0.000
		4/7/02	0.022	--	--	0.017	0.011	--	--	0.011	0.002	--	--	0.002	0.011	--	--	0.006	0.009	--	--	0.009
		4/14/02	0.051	0.028	0.017	0.017	0.012	0.014	0.012	0.010	0.003	0.010	0.003	0.007	0.039	0.014	0.005	0.007	0.009	0.004	0.009	0.003
		4/21/02	0.064	--	--	0.022	0.008	--	--	0.010	0.005	--	--	0.003	0.056	--	--	0.012	0.003	--	--	0.008
FSC-3	Weekly	8/5/01	0.017	--	--	0.011	0.006	--	--	0.006	0.003	--	--	0.003	0.009	--	--	0.006	0.003	--	--	0.003
		8/26/01	0.022	0.021	0.017	0.020	0.010	0.009	0.008	0.008	0.002	0.002	0.001	0.001	0.013	0.012	0.009	0.012	0.008	0.007	0.007	0.007
		9/2/01	0.022	--	--	0.015	0.009	--	--	0.007	0.001	--	--	0.006	0.016	--	--	0.009	0.008	--	--	0.001
		9/9/01	0.021	--	--	0.013	0.007	--	--	0.005	0.004	--	--	0.001	0.011	--	--	0.008	0.003	--	--	0.004
		9/16/01	0.022	--	--	0.012	0.006	--	--	0.006	0.007	--	--	0.002	0.013	--	--	0.006	0.000	--	--	0.004
		9/23/01	0.019	0.015	0.014	0.012	0.007	0.007	0.006	0.005	0.003	0.002	0.003	0.004	0.010	0.008	0.008	0.007	0.004	0.005	0.003	0.001
		9/30/01	0.015	--	--	0.014	0.006	--	--	0.006	0.011	--	--	0.003	0.008	--	--	0.012	0.000	--	--	0.003
		10/7/01	0.016	--	--	0.013	0.008	--	--	0.005	0.004	--	--	0.001	0.007	--	--	0.006	0.004	--	--	0.004
		10/14/01	0.017	--	--	0.013	0.009	--	--	0.007	0.002	--	--	0.003	0.007	--	--	0.006	0.007	--	--	0.004
		10/21/01	0.015	0.018	0.011	0.013	0.007	0.007	0.006	0.006	0.013	0.003	0.002	0.002	0.007	0.011	0.005	0.006	0.000	0.004	0.004	0.004
		10/28/01	0.016	--	--	0.012	0.007	--	--	0.006	0.001	--	--	0.001	0.004	--	--	0.005	0.006	--	--	0.005
		11/4/01	0.014	--	--	0.012	0.007	--	--	0.005	0.002	--	--	0.002	0.006	--	--	0.009	0.005	--	--	0.003
		11/11/01	0.010	--	--	0.010	0.005	--	--	0.005	0.001	--	--	0.001	0.005	--	--	0.005	0.004	--	--	0.004
		11/18/01	0.008	--	--	0.010	0.007	--	--	0.006	0.008	--	--	0.001	0.001	--	--	0.004	0.000	--	--	0.005
		11/25/01	0.015	0.014	0.014	0.012	0.007	0.007	0.006	0.007	0.002	0.001	0.001	0.001	0.008	0.007	0.008	0.005	0.005	0.006	0.005	0.006
		12/9/01	0.018	--	--	0.017	0.011	--	--	0.008	0.002	--	--	0.001	0.007	--	--	0.009	0.009	--	--	0.007
		12/16/01	0.015	0.025	0.018	0.016	0.008	0.008	0.007	0.010	0.001	0.001	0.001	0.002	0.008	0.017	0.011	0.006	0.007	0.007	0.006	0.008
		12/23/01	0.014	--	--	0.016	0.007	--	--	0.007	--	--	--	0.007	--	--	0.009	--	--	--	--	--
		12/30/01	0.021	--	--	0.015	0.008	--	--	0.005	0.002	--	--	0.001	0.013	--	--	0.010	0.006	--	--	0.004
		1/6/02	0.011	--	--	0.015	0.005	--	--	0.005	0.002	--	--	0.002	0.005	--	--	0.010	0.003	--	--	0.003
		1/13/02	0.012	--	--	0.019	0.005	--	--	0.006	0.002	--	--	0.003	0.005	--	--	0.013	0.003	--	--	0.003
		1/20/02	0.016	0.027	0.028	0.018	0.007	0.007	0.006	0.005	0.001	0.001	0.002	0.001	0.009	0.020	0.022	0.013	0.006	0.006	0.004	0.004
		1/27/02	0.015	--	--	0.020	0.005	--	--	0.006	0.002	--	--	0.001	0.010	--	--	0.014	0.003	--	--	0.005
		2/3/02	0.015	--	--	0.015	0.005	--	--	0.005	0.003	--	--	0.001	0.010	--	--	0.011	0.002	--	--	0.004
		2/10/02	0.020	--	--	0.015	0.014	--	--	0.008	0.005	--	--	0.001	0.001	--	--	0.006	0.009	--	--	0.007
		2/17/02	0.022	--	--	0.014	0.011	--	--	0.009	0.002	--	--	0.004	0.015	--	--	0.006	0.009	--	--	0.005
		2/24/02	0.016	0.015	0.014	0.014	0.009	0.008	0.006	0.006	0.003	0.002	0.003	0.001	0.007	0.007	0.008	0.008	0.006	0.006	0.004	0.005
		3/3/02	0.017	--	--	0.013	0.006	--	--	0.005	0.004	--	--	0.004	0.011	--	--	0.008	0.002	--	--	0.001
		3/10/02	0.027	--	--	0.015	0.016	--	--	0.005	0.005	--	--	0.005	0.011	--	--	0.010	0.011	--	--	0.000
		3/17/02	0.047	--	--	0.017	0.012	--	--	0.008	0.002	--	--	0.001	0.035	--	--	0.009	0.010	--	--	0.007
		3/24/02	0.060	0.022	0.021	0.019	0.010	0.010	0.011	0.009	0.003	0.011	0.002	0.001	0.050	0.012	0.010	0.010	0.007	0.000	0.009	0.008
		3/31/02	0.046	--	--	0.025	0.012	--	--	0.008	0.002	--	--	0.016	0.034	--	--	0.017	0.010	--	--	0.000
		4/7/02	0.022	--	--	0.021	0.011	--	--	0.007	0.002	--	--	0.001	0.011	--	--	0.014	0.009	--	--	0.006
		4/14/02	0.051	0.032	0.025	0.021	0.012	0.009	0.010	0.012	0.003	0.002	0.007	0.006	0.039	0.023	0.015	0.010	0.009	0.007	0.003	0.006
		4/21/02	0.064	--	--	0.022	0.008	--	--	0.013	0.005	--	--	0.002	0.056	--	--	0.009	0.003	--	--	0.011
FSC-4	Weekly	11/25/01	0.015	0.011	--	--	0.007	0.006	--	--	0.002	0.003	--	--	0.008	0.005	--	--	0.005	0.003	--	--
		12/16/01	0.015	0.037	0.024	0.027	0.008	0.021	0.010	0.010	0.001	0.012	0.001	0.002	0.008	0.016	0.014	0.018	0.007	0.009	0.009	0.009
		12/23/01	0.014	--	--	0.015	0.007	--	--	0.009	--	--	--	0.007	--	--	--	0.006	--	--	--	--
		12/30/01	0.021	--	--	0.015	0.008	--	--	0.009	0.002	--	--	0.003	0.013	--	--	0.006	0.006	--	--	0.006

APPENDIX B-3

Phosphorus Water Quality Data from the Field-Scale PSTA Cells, August 2001 - April 2002

Cell	Freq	Time Period	TP_mg/L				TDP_mg/L				SRP_mg/L				TPP_mg/L				DOP_mg/L			
			InflCnl	Inflow	stn_1/2	Outflow	InflCnl	Inflow	stn_1/2	Outflow	InflCnl	Inflow	stn_1/2	Outflow	InflCnl	Inflow	stn_1/2	Outflow	InflCnl	Inflow	stn_1/2	Outflow
		1/6/02	0.011	--	--	0.010	0.005	--	--	0.007	0.002	--	--	0.002	0.005	--	--	0.002	0.003	--	--	0.005
		1/13/02	0.012	--	--	0.020	0.005	--	--	0.007	0.002	--	--	0.004	0.005	--	--	0.017	0.003	--	--	0.003
		1/20/02	0.016	0.016	0.022	0.022	0.007	0.008	0.010	0.018	0.001	0.002	0.001	0.003	0.009	0.008	0.012	0.002	0.006	0.006	0.009	0.015
		2/10/02	0.020	--	--	0.022	0.014	--	--	0.010	0.005	--	--	0.001	0.001	--	--	0.012	0.009	--	--	0.009
		2/17/02	0.022	--	--	0.022	0.011	--	--	0.009	0.002	--	--	0.002	0.015	--	--	0.013	0.009	--	--	0.007
		2/24/02	0.016	0.016	0.017	0.012	0.009	0.006	0.007	0.008	0.003	0.003	0.002	0.002	0.007	0.010	0.010	0.004	0.006	0.003	0.005	0.006
		3/10/02	0.027	--	--	0.018	0.016	--	--	0.009	0.005	--	--	0.005	0.011	--	--	0.009	0.011	--	--	0.004
		3/17/02	0.047	--	--	0.024	0.012	--	--	0.012	0.002	--	--	0.002	0.035	--	--	0.012	0.010	--	--	0.010
		3/24/02	0.060	0.024	--	--	0.010	0.011	--	--	0.003	0.004	--	--	0.050	0.013	--	--	0.007	0.007	--	--
		3/31/02	0.046	--	--	0.037	0.012	--	--	0.022	0.002	--	--	0.011	0.034	--	--	0.015	0.010	--	--	0.011
		4/7/02	0.022	--	--	0.031	0.011	--	--	0.012	0.002	--	--	0.008	0.011	--	--	0.019	0.009	--	--	0.004
		4/21/02	0.064	0.017	0.041	0.036	0.008	0.008	0.014	0.013	0.005	0.002	0.008	0.009	0.056	0.009	0.027	0.023	0.003	0.006	0.006	0.004

APPENDIX B-4

Total Phosphorus Mass Balance Summary from the Field-Scale PSTA Cells, August 2001 - October 2001

Cell	Freq	Time Period	TP (mg/L)		Flow (m <sup>3</sup> /d)			HLR (cm/d)			MB_TP (g/m <sup>2</sup> /y)		Removal		Calc_k (m/y)
			Inflow	Outflow	Inflow	Outflow	Average	q_in	q_out	q_avg	Inflow	Outflow	(g/m <sup>2</sup> /y)	(%)	
FSC-1	Weekly	8/5/01	0.017	0.013	1084.3	4595.1	2839.7	5.36	22.71	14.03	0.323	1.036	-0.713	-221.05	14.22
		8/26/01	0.022	0.025	2530.0	1276.2	1903.1	12.50	6.31	9.41	1.004	0.570	0.434	43.25	-4.04
		9/2/01	0.022	0.028	722.9	267.9	495.4	3.57	1.32	2.45	0.280	0.135	0.145	51.74	-2.36
		9/9/01	0.021	0.014	0.0	346.5	173.3	0.00	1.71	0.86	0.000	0.088	-0.088	--	1.19
		10/7/01	0.016	0.014	1445.7	806.6	1126.2	7.14	3.99	5.57	0.404	0.196	0.208	51.41	2.81
		10/14/01	0.018	0.015	1445.7	331.6	888.7	7.14	1.64	4.39	0.469	0.090	0.380	80.88	2.92
		10/21/01	0.021	0.015	2168.6	1323.5	1746.0	10.72	6.54	8.63	0.802	0.358	0.444	55.34	9.84
		11/4/01	0.013	0.023	0.0	59.2	29.6	0.00	0.29	0.15	0.000	0.025	-0.025	--	-0.30
		11/11/01	0.010	0.017	1454.0	334.0	894.0	7.19	1.65	4.42	0.262	0.102	0.160	60.95	-8.56
		11/25/01	0.017	--	365.8	0.0	182.9	1.81	0.00	0.90	0.112	--	--	--	--
		12/16/01	0.018	0.045	1784.1	161.8	973.0	8.82	0.80	4.81	0.563	0.130	0.433	76.94	-16.38
		1/6/02	0.011	0.017	2470.7	824.7	1647.7	12.21	4.08	8.14	0.490	0.257	0.234	47.66	-13.37
		1/13/02	0.012	0.020	2692.0	1253.8	1972.9	13.30	6.20	9.75	0.558	0.447	0.112	20.01	-19.25
		1/20/02	0.019	0.018	2590.7	1289.7	1940.2	12.80	6.37	9.59	0.876	0.407	0.469	53.54	2.41
		1/27/02	0.015	0.018	2108.1	805.4	1456.8	10.42	3.98	7.20	0.570	0.257	0.314	55.01	-4.30
		2/3/02	0.015	0.023	2422.0	1044.3	1733.2	11.97	5.16	8.57	0.634	0.424	0.210	33.09	-13.74
		2/10/02	0.020	0.018	2707.6	1642.8	2175.2	13.38	8.12	10.75	0.952	0.541	0.412	43.22	2.60
		2/17/02	0.022	0.016	2801.3	1710.8	2256.0	13.84	8.45	11.15	1.086	0.478	0.608	55.97	13.32
		2/24/02	0.016	0.014	2869.4	1719.9	2294.6	14.18	8.50	11.34	0.828	0.434	0.394	47.55	5.53
		3/3/02	0.017	0.016	2515.4	1405.9	1960.7	12.43	6.95	9.69	0.771	0.406	0.366	47.40	2.14
		3/10/02	0.027	0.017	2366.4	1207.8	1787.1	11.70	5.97	8.83	1.153	0.370	0.782	67.86	14.91
		3/17/02	0.047	0.019	1968.6	997.4	1483.0	9.73	4.93	7.33	1.669	0.342	1.327	79.52	24.23
		3/24/02	0.025	--	1873.3	545.6	1209.4	9.26	2.70	5.98	0.845	--	--	--	--
		3/31/02	0.046	0.028	2165.7	978.8	1572.3	10.70	4.84	7.77	1.797	0.486	1.312	72.98	14.59
		4/7/02	0.022	0.024	1827.4	632.4	1229.9	9.03	3.13	6.08	0.725	0.274	0.451	62.25	-1.93
		4/14/02	0.025	0.047	2061.0	985.8	1523.4	10.19	4.87	7.53	0.929	0.836	0.094	10.08	-17.35
		4/21/02	0.064	0.021	1951.9	732.9	1342.4	9.65	3.62	6.63	2.253	0.278	1.976	87.68	26.98
FSC-2	Weekly	9/2/01	0.022	0.020	963.7	375.4	669.6	4.76	1.86	3.31	0.374	0.137	0.237	63.31	0.72
		9/16/01	0.025	0.018	1927.4	557.9	1242.7	9.53	2.76	6.14	0.869	0.181	0.688	79.16	7.36
		9/23/01	0.019	0.015	3373.0	2743.0	3058.0	16.67	13.56	15.11	1.141	0.742	0.399	34.94	12.31
		9/30/01	0.015	0.010	3373.0	2589.5	2981.2	16.67	12.80	14.73	0.882	0.467	0.415	47.06	19.98
		10/7/01	0.016	0.013	3373.0	2305.1	2839.1	16.67	11.39	14.03	0.943	0.520	0.423	44.89	11.02
		10/14/01	0.017	0.013	3373.0	1989.6	2681.3	16.67	9.83	13.25	1.034	0.467	0.568	54.89	12.98
		10/21/01	0.021	0.014	3373.0	2478.4	2925.7	16.67	12.25	14.46	1.247	0.604	0.644	51.61	22.05
		10/28/01	0.016	0.011	3373.0	1185.9	2279.4	16.67	5.86	11.27	0.943	0.235	0.708	75.05	14.10
		11/4/01	0.014	0.012	2970.7	2263.7	2617.2	14.68	11.19	12.93	0.723	0.470	0.254	35.09	7.57
		11/11/01	0.010	0.010	3267.7	1846.2	2557.0	16.15	9.12	12.64	0.589	0.333	0.256	43.50	0.00
		11/25/01	0.017	--	624.8	0.0	312.4	3.09	0.00	1.54	0.192	--	--	--	--
		12/9/01	0.018	0.036	2672.6	384.7	1528.6	13.21	1.90	7.55	0.868	0.246	0.621	71.61	-18.73

APPENDIX B-4

Total Phosphorus Mass Balance Summary from the Field-Scale PSTA Cells, August 2001 - October 2001

Cell	Freq	Time Period	TP (mg/L)		Flow (m <sup>3</sup> /d)			HLR (cm/d)			MB_TP (g/m <sup>2</sup> /y)		Removal		Calc_k (m/y)
			Inflow	Outflow	Inflow	Outflow	Average	q_in	q_out	q_avg	Inflow	Outflow	(g/m <sup>2</sup> /y)	(%)	
		12/16/01	0.017	0.018	3206.6	1253.3	2230.0	15.85	6.19	11.02	0.983	0.407	0.576	58.61	-2.30
		12/23/01	0.014	0.016	3412.0	1687.5	2549.8	16.86	8.34	12.60	0.862	0.472	0.390	45.24	-4.68
		1/6/02	0.010	0.013	1165.4	747.9	956.7	5.76	3.70	4.73	0.210	0.175	0.035	16.57	-4.53
		1/13/02	0.012	0.013	2006.0	656.0	1331.0	9.91	3.24	6.58	0.416	0.154	0.262	63.04	-2.94
		1/20/02	0.018	0.017	3254.3	1648.4	2451.3	16.08	8.15	12.11	1.027	0.505	0.522	50.80	1.28
		1/27/02	0.015	0.015	2863.9	1187.7	2025.8	14.15	5.87	10.01	0.775	0.311	0.464	59.91	1.24
		2/3/02	0.015	0.013	2730.1	1003.3	1866.7	13.49	4.96	9.23	0.714	0.226	0.488	68.32	5.00
		2/10/02	0.020	0.015	2903.6	1305.9	2104.8	14.35	6.45	10.40	1.021	0.342	0.680	66.56	11.25
		2/17/02	0.022	0.017	3062.1	1465.0	2263.6	15.13	7.24	11.19	1.188	0.436	0.752	63.28	10.81
		2/24/02	0.019	0.012	3067.1	1461.2	2264.1	15.16	7.22	11.19	1.051	0.316	0.735	69.91	18.77
		3/3/02	0.017	0.019	2977.3	1542.6	2259.9	14.71	7.62	11.17	0.913	0.529	0.384	42.09	-4.53
		3/10/02	0.027	0.014	3080.7	1471.1	2275.9	15.23	7.27	11.25	1.500	0.372	1.129	75.24	26.96
		3/17/02	0.047	0.016	3016.0	1333.4	2174.7	14.91	6.59	10.75	2.557	0.385	2.172	84.95	42.27
		3/24/02	0.023	0.016	3057.6	1333.4	2195.5	15.11	6.59	10.85	1.269	0.385	0.884	69.66	14.37
		3/31/02	0.046	0.018	3282.1	1693.1	2487.6	16.22	8.37	12.29	2.723	0.550	2.174	79.81	42.10
		4/7/02	0.022	0.017	3194.7	1747.1	2470.9	15.79	8.63	12.21	1.268	0.536	0.732	57.74	11.49
		4/14/02	0.028	0.017	3017.1	1764.4	2390.8	14.91	8.72	11.82	1.524	0.541	0.983	64.49	21.52
		4/21/02	0.064	0.022	2504.4	1412.7	1958.5	12.38	6.98	9.68	2.891	0.561	2.331	80.61	37.73
FSC-3	Weekly	8/5/01	0.017	0.011	1337.6	6176.2	3756.9	6.61	30.52	18.57	0.398	1.226	-0.827	-207.83	27.48
		8/26/01	0.021	0.020	3121.0	2856.3	2988.6	15.42	14.12	14.77	1.154	1.005	0.149	12.95	2.70
		9/2/01	0.022	0.015	445.9	357.3	401.6	2.20	1.77	1.98	0.173	0.097	0.076	44.08	2.61
		9/9/01	0.021	0.013	2229.3	3108.5	2668.9	11.02	15.36	13.19	0.824	0.715	0.109	13.27	22.86
		9/16/01	0.022	0.012	1337.6	2246.0	1791.8	6.61	11.10	8.86	0.531	0.496	0.035	6.50	18.92
		9/23/01	0.018	0.012	2675.1	2535.5	2605.3	13.22	12.53	12.88	0.844	0.549	0.296	35.01	17.73
		9/30/01	0.015	0.014	2229.3	3278.8	2754.0	11.02	16.20	13.61	0.583	0.843	-0.260	-44.54	0.86
		10/7/01	0.016	0.013	2229.3	2971.7	2600.5	11.02	14.69	12.85	0.623	0.670	-0.047	-7.50	10.09
		10/14/01	0.017	0.013	2675.1	2928.9	2802.0	13.22	14.48	13.85	0.820	0.687	0.134	16.28	13.56
		10/21/01	0.017	0.013	1337.6	1532.8	1435.2	6.61	7.58	7.09	0.398	0.346	0.053	13.19	7.19
		10/28/01	0.016	0.012	3121.0	3522.7	3321.9	15.42	17.41	16.42	0.873	0.731	0.142	16.26	17.89
		11/4/01	0.014	0.012	2559.0	3630.7	3094.9	12.65	17.94	15.30	0.623	0.753	-0.130	-20.86	8.95
		11/11/01	0.010	0.010	1415.4	2185.8	1800.6	7.00	10.80	8.90	0.255	0.394	-0.139	-54.43	0.00
		11/18/01	0.008	0.010	584.3	3118.2	1851.2	2.89	15.41	9.15	0.084	0.562	-0.478	-567.06	-7.45
		11/25/01	0.014	0.012	1.8	1893.6	947.7	0.01	9.36	4.68	0.000	0.410	-0.409	-88213	2.64
		12/9/01	0.018	0.017	645.3	700.2	672.7	3.19	3.46	3.32	0.210	0.215	-0.005	-2.47	0.69
		12/16/01	0.020	0.016	688.0	592.1	640.0	3.40	2.93	3.16	0.242	0.166	0.076	31.59	2.65
		12/23/01	0.014	0.016	370.4	279.6	325.0	1.83	1.38	1.61	0.094	0.081	0.013	13.75	-0.78
		12/30/01	0.021	0.015	598.7	782.7	690.7	2.96	3.87	3.41	0.227	0.212	0.015	6.62	4.19
		1/6/02	0.011	0.015	524.3	460.0	492.1	2.59	2.27	2.43	0.104	0.124	-0.020	-19.63	-2.75
		1/13/02	0.012	0.019	124.6	206.4	165.5	0.62	1.02	0.82	0.026	0.069	-0.043	-166.34	-1.42

APPENDIX B-4

Total Phosphorus Mass Balance Summary from the Field-Scale PSTA Cells, August 2001 - October 2001

Cell	Freq	Time Period	TP (mg/L)		Flow (m <sup>3</sup> /d)			HLR (cm/d)			MB_TP (g/m <sup>2</sup> /y)		Removal		Calc_k (m/y)
			Inflow	Outflow	Inflow	Outflow	Average	q_in	q_out	q_avg	Inflow	Outflow	(g/m <sup>2</sup> /y)	(%)	
		1/20/02	0.022	0.018	171.4	176.8	174.1	0.85	0.87	0.86	0.066	0.057	0.009	13.62	0.56
		1/27/02	0.015	0.020	482.4	931.9	707.1	2.38	4.61	3.49	0.131	0.336	-0.206	-157.56	-3.67
		2/3/02	0.015	0.015	309.5	1075.6	692.6	1.53	5.32	3.42	0.081	0.281	-0.200	-247.51	0.00
		2/10/02	0.020	0.015	1033.7	1777.2	1405.4	5.11	8.78	6.95	0.364	0.465	-0.101	-27.85	7.51
		2/17/02	0.022	0.014	1916.7	2342.8	2129.7	9.47	11.58	10.53	0.743	0.592	0.152	20.41	16.48
		2/24/02	0.015	0.014	1459.7	2356.2	1908.0	7.21	11.64	9.43	0.395	0.595	-0.200	-50.65	2.37
		3/3/02	0.017	0.013	367.5	1140.3	753.9	1.82	5.64	3.73	0.113	0.267	-0.155	-137.26	3.65
		3/10/02	0.027	0.015	372.4	1436.4	904.4	1.84	7.10	4.47	0.181	0.389	-0.207	-114.32	9.59
		3/17/02	0.047	0.017	547.0	2436.6	1491.8	2.70	12.04	7.37	0.464	0.747	-0.283	-61.11	27.37
		3/24/02	0.022	0.019	575.4	2074.5	1324.9	2.84	10.25	6.55	0.228	0.711	-0.483	-211.37	3.50
		3/31/02	0.046	0.025	81.2	81.8	81.5	0.40	0.40	0.40	0.067	0.037	0.031	45.27	0.90
		4/7/02	0.022	0.021	358.4	1900.2	1129.3	1.77	9.39	5.58	0.142	0.720	-0.578	-406.15	0.95
		4/14/02	0.032	0.021	984.7	3320.0	2152.3	4.87	16.41	10.64	0.568	1.258	-0.689	-121.26	16.35
		4/21/02	0.064	0.022	284.0	1429.1	856.6	1.40	7.06	4.23	0.328	0.567	-0.239	-72.95	16.50
FSC-4	Weekly	11/25/01	0.011	--	1147.7	0.0	573.8	5.67	0.00	2.84	0.228	--	--	--	--
		12/16/01	0.026	0.027	3200.0	1354.5	2277.3	15.81	6.69	11.25	1.472	0.654	0.818	55.60	-1.97
		12/23/01	0.014	0.015	3200.0	2337.6	2768.8	15.81	11.55	13.68	0.808	0.633	0.176	21.73	-3.45
		12/30/01	0.021	0.015	3200.0	1899.8	2549.9	15.81	9.39	12.60	1.212	0.514	0.698	57.59	15.48
		1/6/02	0.011	0.010	3082.1	1167.3	2124.7	15.23	5.77	10.50	0.612	0.200	0.412	67.29	5.62
		1/13/02	0.012	0.020	2944.4	800.6	1872.5	14.55	3.96	9.25	0.611	0.289	0.322	52.71	-18.69
		1/20/02	0.016	0.022	2469.4	534.9	1502.2	12.20	2.64	7.42	0.713	0.212	0.500	70.21	-8.63
		2/10/02	0.020	0.022	3228.1	623.3	1925.7	15.95	3.08	9.52	1.136	0.242	0.894	78.71	-3.39
		2/17/02	0.022	0.022	3263.3	939.0	2101.1	16.13	4.64	10.38	1.266	0.368	0.897	70.89	-0.44
		2/24/02	0.016	0.012	2810.0	558.2	1684.1	13.89	2.76	8.32	0.811	0.121	0.690	85.10	8.74
		3/10/02	0.027	0.018	2864.6	154.8	1509.7	14.16	0.76	7.46	1.395	0.050	1.345	96.40	11.04
		3/17/02	0.047	0.024	2809.0	67.8	1438.4	13.88	0.33	7.11	2.382	0.029	2.352	98.77	17.44
		3/24/02	0.024	--	2043.3	303.8	1173.5	10.10	1.50	5.80	0.885	--	--	--	--
		3/31/02	0.046	0.037	3209.3	1106.6	2158.0	15.86	5.47	10.66	2.663	0.739	1.924	72.26	8.48
		4/7/02	0.022	0.031	2101.0	697.7	1399.4	10.38	3.45	6.92	0.834	0.390	0.444	53.20	-8.66
		4/21/02	0.017	0.036	1857.1	290.6	1073.9	9.18	1.44	5.31	0.570	0.189	0.381	66.86	-14.53

APPENDIX B-5

Metabolism Data from the Field-Scale PSTA Cells, August 2001 - April 2002

Cell	Freq	Time Period	GPP(day)		CR(24hr)	NPP(24hr)		NPP(day)	Avg Night Res	PAR(24hr)	Efficiency
			g/m <sup>2</sup> /d	g/m <sup>2</sup> /d		P/R Ratio	g/m <sup>2</sup> /d				
FSC-1	Weekly	08/26/2001	2.27	2.39	0.95	-0.12	0.88	0.10	31.7	1.395	
		09/02/2001	1.77	1.77	1.00	0.00	0.75	0.07	14.0	4.734	
		09/09/2001	2.01	1.87	1.08	0.15	0.92	0.08	17.9	2.143	
		09/23/2001	1.49	1.40	1.06	0.08	0.73	0.06	8.8	3.387	
		09/30/2001	1.69	1.60	1.06	0.09	0.77	0.07	32.8	1.026	
		10/07/2001	1.87	2.01	0.93	-0.13	0.77	0.08	29.8	1.208	
		10/14/2001	2.03	2.02	1.00	0.00	0.93	0.08	18.2	2.194	
		10/21/2001	2.76	2.63	1.05	0.13	1.33	0.11	17.7	3.248	
		10/28/2001	1.01	1.11	0.91	-0.10	0.41	0.05	17.4	1.124	
		11/04/2001	1.53	1.50	1.02	0.04	0.72	0.06	22.5	1.318	
		11/11/2001	2.16	2.18	0.99	-0.02	0.90	0.09	19.0	2.704	
		11/18/2001	1.40	1.41	1.00	0.00	0.64	0.06	21.6	1.249	
		11/25/2001	1.31	1.09	1.20	0.22	0.76	0.05	19.9	1.252	
		12/09/2001	2.61	2.86	0.91	-0.24	1.19	0.12	19.4	2.582	
		12/16/2001	3.47	3.32	1.05	0.16	1.82	0.14	17.2	3.906	
		12/23/2001	2.15	2.09	1.03	0.06	1.10	0.09	14.9	2.812	
		12/30/2001	1.61	1.66	0.97	-0.05	0.78	0.07	10.0	3.640	
		01/06/2002	1.48	1.54	0.96	-0.06	0.71	0.06	20.6	1.377	
		01/13/2002	2.02	2.15	0.94	-0.14	0.94	0.09	12.5	3.330	
		01/20/2002	4.82	4.73	1.02	0.09	2.45	0.20	23.6	3.906	
		01/27/2002	4.95	5.15	0.96	-0.21	2.32	0.21	20.5	4.642	
		02/03/2002	2.93	2.95	0.99	-0.02	1.40	0.12	18.6	3.088	
		02/10/2002	4.01	3.79	1.06	0.23	2.08	0.16	19.1	4.111	
		02/17/2002	2.25	2.68	0.84	-0.43	0.69	0.11	8.8	4.903	
		02/24/2002	3.05	2.67	1.14	0.38	1.69	0.11	30.1	1.957	
		03/03/2002	2.39	2.31	1.03	0.07	1.09	0.10	21.5	2.755	
		03/10/2002	4.66	5.65	0.83	-0.99	1.37	0.24	29.7	2.997	
		03/17/2002	2.84	3.06	0.93	-0.23	1.05	0.13	30.5	1.858	
		03/24/2002	1.15	1.40	0.82	-0.25	0.34	0.06	39.5	0.558	
		03/31/2002	4.99	4.77	1.05	0.22	2.21	0.20	34.0	2.793	
		04/07/2002	2.20	2.27	0.97	-0.07	0.88	0.09	31.0	1.374	
		04/14/2002	2.63	2.57	1.02	0.06	1.13	0.11	31.8	1.669	
04/21/2002	4.95	4.99	0.99	-0.03	2.04	0.21	39.6	2.393			
FSC-2	Weekly	09/23/2001	2.63	2.07	1.27	0.56	1.51	0.09	9.3	6.312	
		09/30/2001	3.90	3.83	1.02	0.08	1.67	0.16	31.1	2.574	
		10/07/2001	3.88	3.82	1.02	0.06	1.75	0.16	28.0	2.801	
		11/04/2001	5.25	5.01	1.05	0.24	2.53	0.21	21.9	4.586	
		12/30/2001	2.63	2.75	0.96	-0.12	1.25	0.11	16.5	3.285	
		01/06/2002	2.62	2.47	1.06	0.15	1.38	0.10	16.9	3.337	
		01/13/2002	2.97	3.31	0.90	-0.34	1.32	0.14	17.2	3.280	
		01/20/2002	4.61	4.26	1.08	0.35	2.48	0.18	20.5	4.347	
		01/27/2002	3.79	3.92	0.97	-0.13	1.75	0.16	21.8	3.336	
		02/03/2002	3.33	3.21	1.04	0.12	1.62	0.13	23.1	2.745	
		02/10/2002	2.99	3.42	0.87	-0.43	1.28	0.14	10.7	9.052	
		02/17/2002	3.31	3.06	1.08	0.26	1.66	0.13	24.5	2.651	
		02/24/2002	2.60	2.94	0.88	-0.35	1.00	0.12	19.0	3.192	
		03/03/2002	3.39	3.48	0.98	-0.09	1.51	0.14	12.4	5.237	
		03/10/2002	4.72	4.73	1.00	-0.01	1.96	0.20	32.1	2.817	
		03/17/2002	4.81	4.84	0.99	-0.03	1.98	0.20	37.2	2.467	
03/24/2002	3.09	3.23	0.96	-0.14	1.21	0.13	35.6	1.666			
03/31/2002	3.01	3.15	0.96	-0.14	1.17	0.13	28.9	2.028			
04/07/2002	3.97	3.93	1.01	0.04	1.68	0.16	27.0	2.898			
04/14/2002	4.66	5.25	0.89	-0.59	1.60	0.22	15.1	5.911			
FSC-3	Weekly	08/26/2001	1.24	1.39	0.90	-0.14	0.44	0.06	31.4	0.759	
		09/02/2001	1.10	1.15	0.96	-0.04	0.43	0.05	14.1	3.015	
		09/09/2001	1.08	0.99	1.10	0.10	0.51	0.04	17.9	1.170	
		09/23/2001	1.70	1.88	0.91	-0.17	0.50	0.08	7.5	5.371	
		01/20/2002	0.82	0.91	0.91	-0.08	0.37	0.04	22.9	0.689	

APPENDIX B-5

Metabolism Data from the Field-Scale PSTA Cells, August 2001 - April 2002

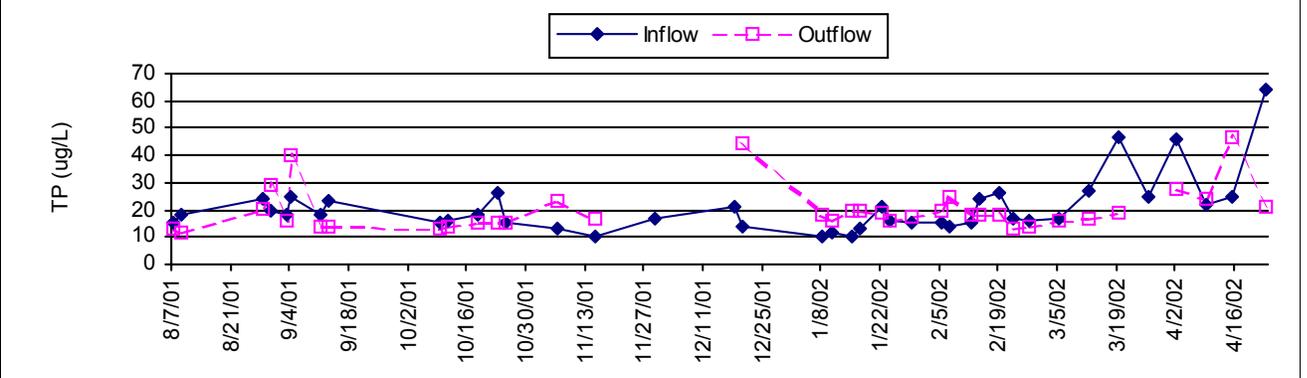
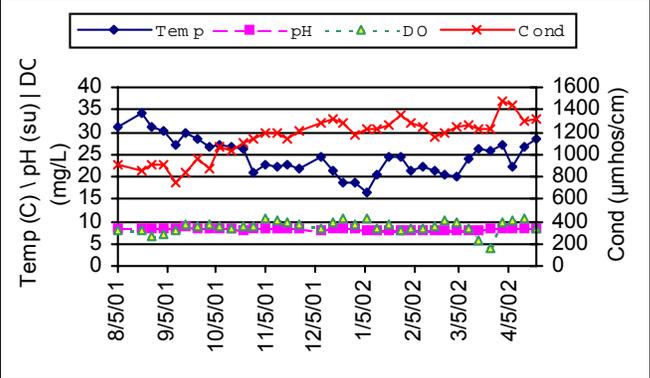
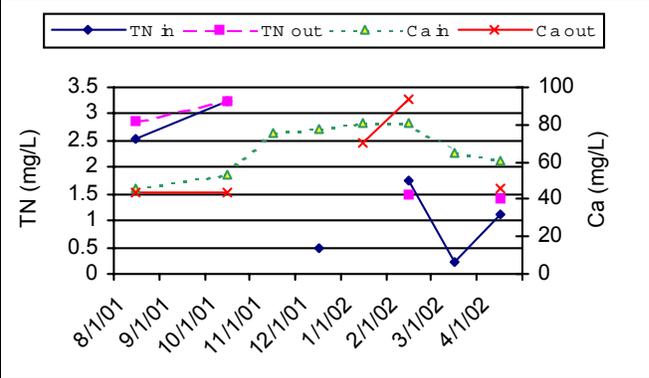
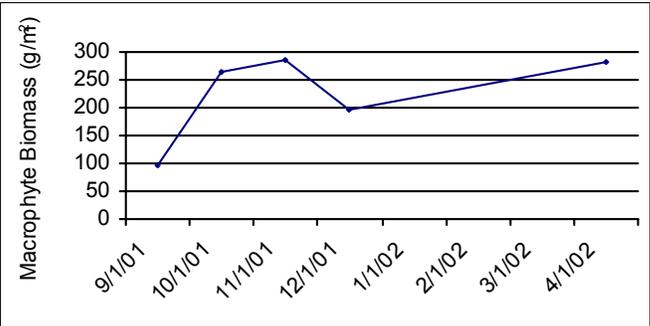
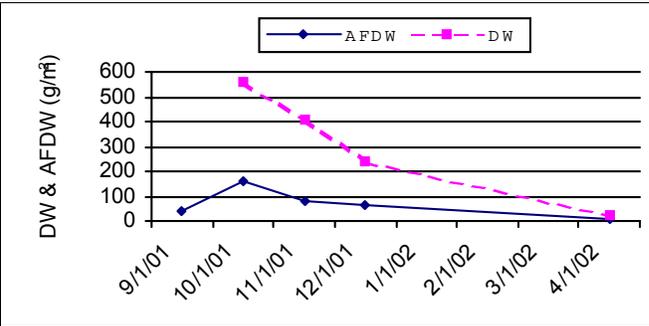
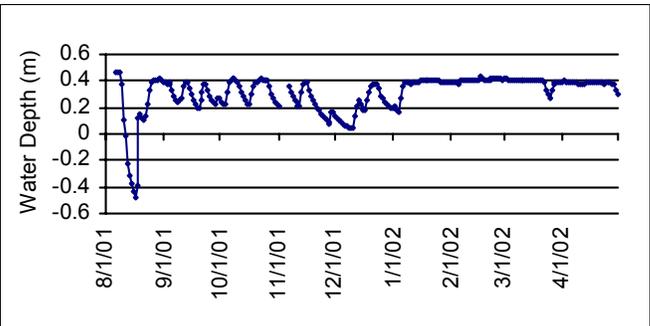
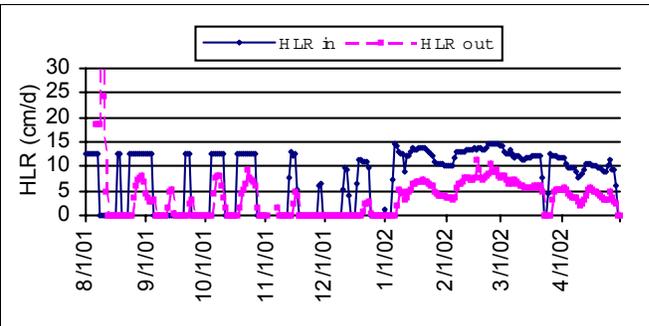
Cell	Freq	Time Period	GPP(day)		CR(24hr)	NPP(24hr)		NPP(day)	Avg Night Res	PAR(24hr)	Efficiency
			g/m <sup>2</sup> /d	g/m <sup>2</sup> /d		P/R Ratio	g/m <sup>2</sup> /d				
		01/27/2002	1.06	1.05	1.01	0.01	0.51	0.04	21.8	0.930	
		02/03/2002	0.89	0.84	1.06	0.05	0.44	0.03	22.3	0.748	
		02/10/2002	0.79	0.94	0.84	-0.16	0.32	0.04	10.7	2.499	
		02/17/2002	0.71	0.63	1.13	0.08	0.37	0.03	24.5	0.568	
		02/24/2002	0.55	0.74	0.74	-0.19	0.15	0.03	19.0	0.646	
		03/03/2002	1.06	0.85	1.25	0.21	0.59	0.04	18.8	1.310	
		03/10/2002	1.60	1.62	0.98	-0.03	0.65	0.07	32.1	0.957	
		03/17/2002	1.43	1.49	0.96	-0.06	0.56	0.06	37.2	0.734	
		03/24/2002	1.72	1.76	0.98	-0.04	0.70	0.07	35.6	0.922	
		03/31/2002	1.25	1.30	0.96	-0.05	0.49	0.05	28.9	0.851	
		04/07/2002	1.67	1.79	0.93	-0.12	0.62	0.07	27.0	1.227	
		04/14/2002	1.58	1.67	0.95	-0.09	0.61	0.07	29.0	1.218	
		04/21/2002	1.23	1.40	0.88	-0.16	0.42	0.06	39.6	0.597	
FSC-4	Weekly	09/23/2001	0.49	0.37	1.31	0.11	0.33	0.02	8.4	1.246	
		09/30/2001	2.64	2.90	0.91	-0.26	0.99	0.12	30.3	1.753	
		10/07/2001	2.09	2.18	0.96	-0.09	0.89	0.09	33.0	1.219	
		10/14/2001	1.58	1.71	0.92	-0.13	0.65	0.07	19.3	1.635	
		10/28/2001	1.84	1.74	1.05	0.09	0.89	0.07	16.8	2.085	
		11/25/2001	0.77	0.80	0.97	-0.03	0.37	0.03	18.0	0.820	
		12/09/2001	4.14	4.18	0.99	-0.04	2.05	0.17	17.3	4.595	
		12/16/2001	3.56	3.48	1.02	0.08	1.82	0.14	19.6	3.480	
		01/20/2002	2.82	2.97	0.95	-0.16	1.33	0.12	23.6	2.282	
		01/27/2002	1.89	2.09	0.90	-0.21	0.82	0.09	20.3	1.805	
		02/03/2002	2.62	2.56	1.03	0.07	1.31	0.11	18.6	3.102	
		02/10/2002	2.98	3.07	0.97	-0.09	1.41	0.13	19.1	3.122	
		02/17/2002	1.17	0.78	1.50	0.39	0.72	0.03	8.8	2.547	
		02/24/2002	1.65	1.56	1.06	0.09	0.79	0.06	30.3	1.049	
		03/03/2002	2.46	2.56	0.96	-0.10	1.01	0.11	21.5	2.806	
		03/10/2002	3.18	3.51	0.91	-0.33	1.13	0.15	30.5	2.003	
		03/17/2002	3.69	3.69	1.00	0.00	1.54	0.15	30.5	2.421	
		03/24/2002	3.40	3.73	0.91	-0.33	1.23	0.16	39.4	1.654	
		03/31/2002	3.95	3.91	1.01	0.04	1.67	0.16	34.0	2.246	
		04/07/2002	2.30	2.23	1.03	0.08	1.01	0.09	31.0	1.429	

Note:

Diffusion Rate: 0.01 g/m<sup>2</sup>/h

# PSTA Research and Demonstration Project Phase 3 Field Scale PSTAs

<b>Treatment:</b> FS-1	<b>Period:</b> 8/1/2001 - 6/27/2002
<b>Cell Size:</b> 66 x 315 m (2.08 ha)	<b>Soil:</b> Limerock fill over peat

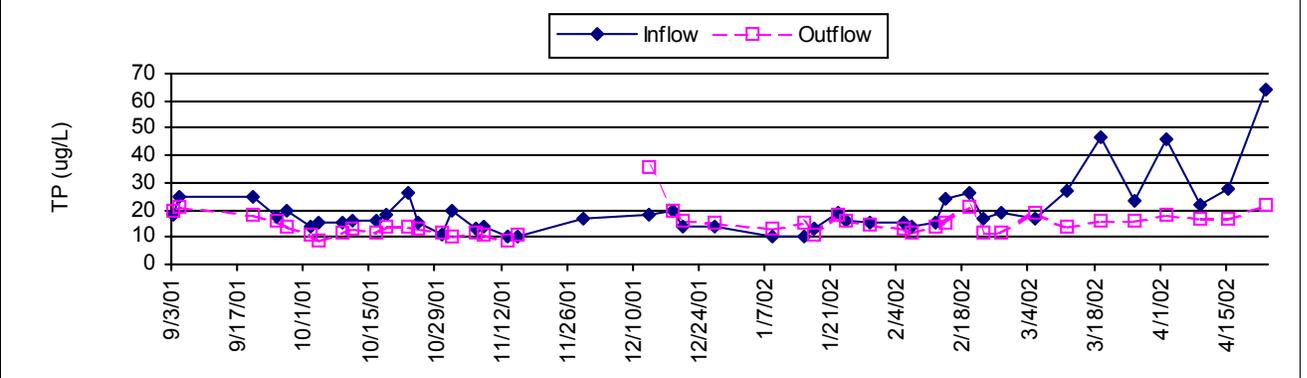
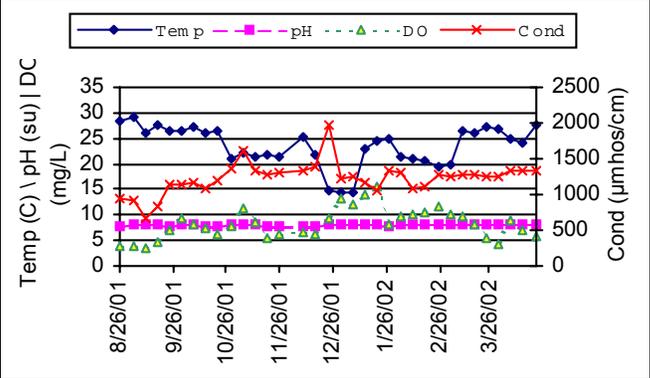
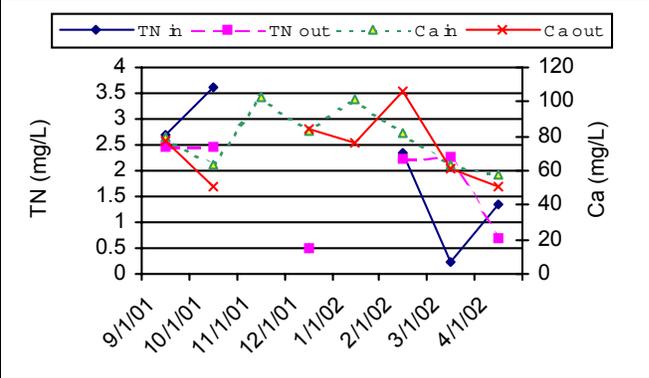
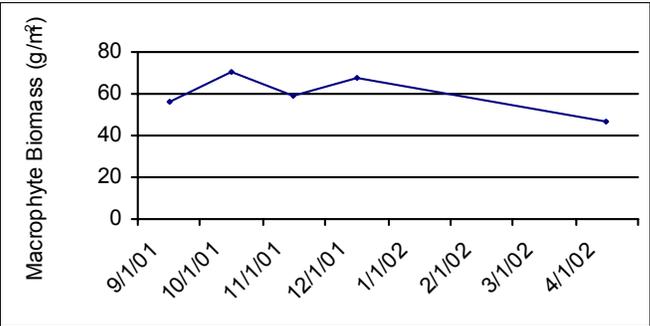
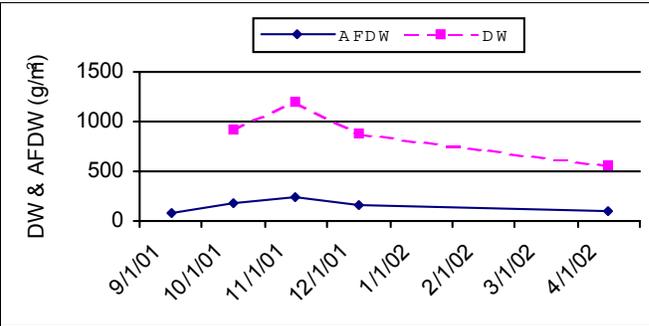
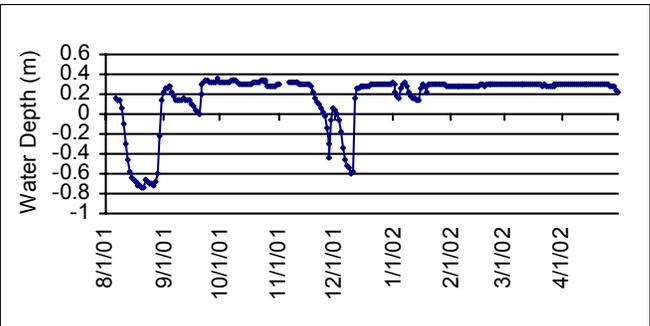
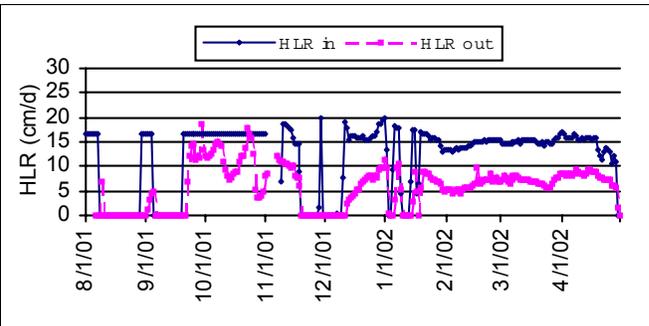


### Summary for Period

Cell	Avg HLR (cm/d)	Depth (m)	TP in (ug/L)	TP out (ug/L)	$k_1$ (m/yr)
FS-1	5.55	0.31	21	20	0.6

# PSTA Research and Demonstration Project Phase 3 Field Scale PSTAs

<b>Treatment:</b> FS-2	<b>Period:</b> 8/1/2001 - 6/27/2002
<b>Cell Size:</b> 22 x 945 m (2.08 ha)	<b>Soil:</b> Limerock fill over peat

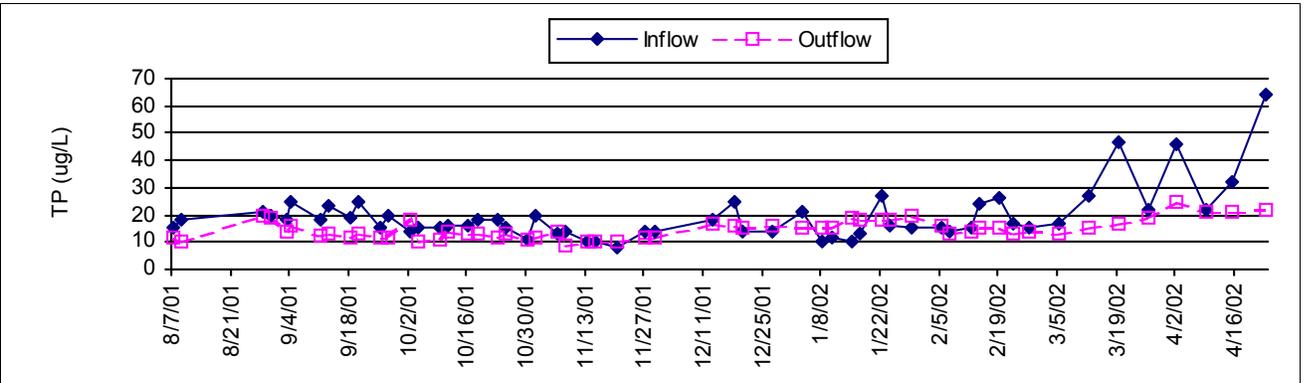
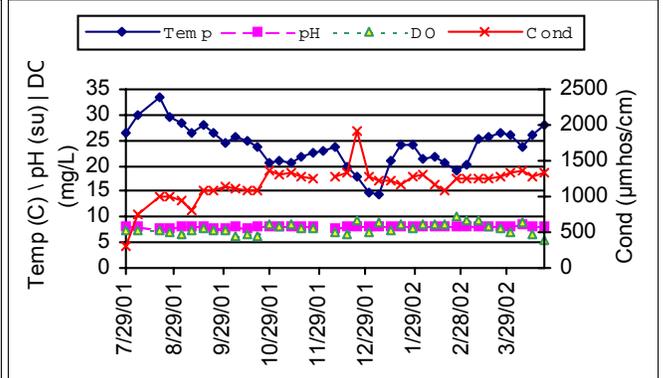
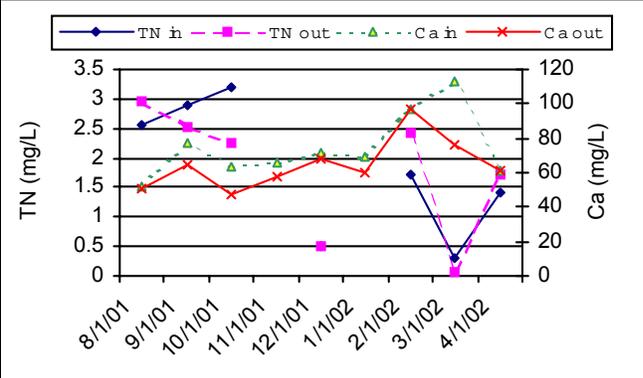
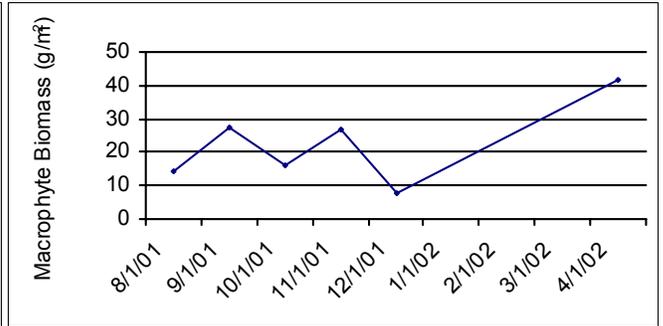
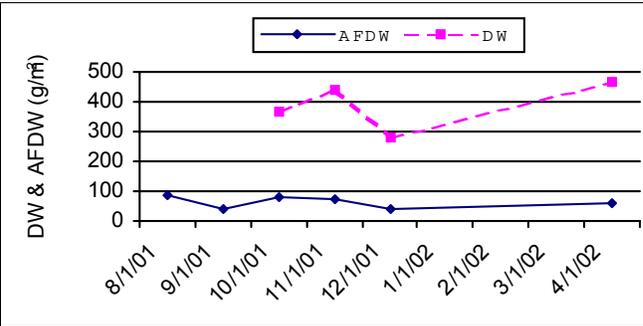
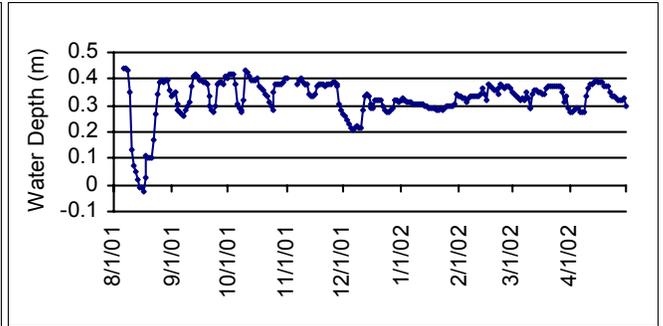
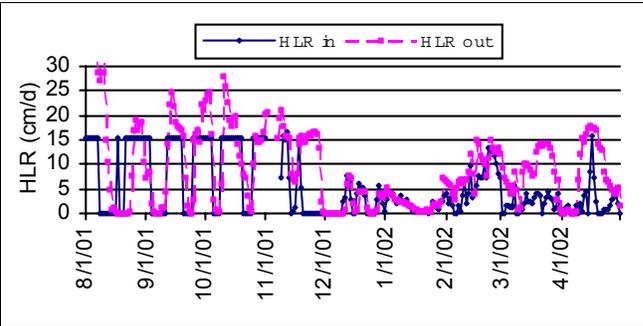


### Summary for Period

Cell	Avg HLR (cm/d)	Depth (m)	TP in (ug/L)	TP out (ug/L)	$k_1$ (m/yr)
FS-2	8.71	0.17	20	15	8.5

# PSTA Research and Demonstration Project Phase 3 Field Scale PSTAs

**Treatment:** FS-3      **Period:** 8/1/2001 - 6/27/2002  
**Cell Size:** 66 x 315 m (2.08 ha)      **Soil:** Limestone caprock

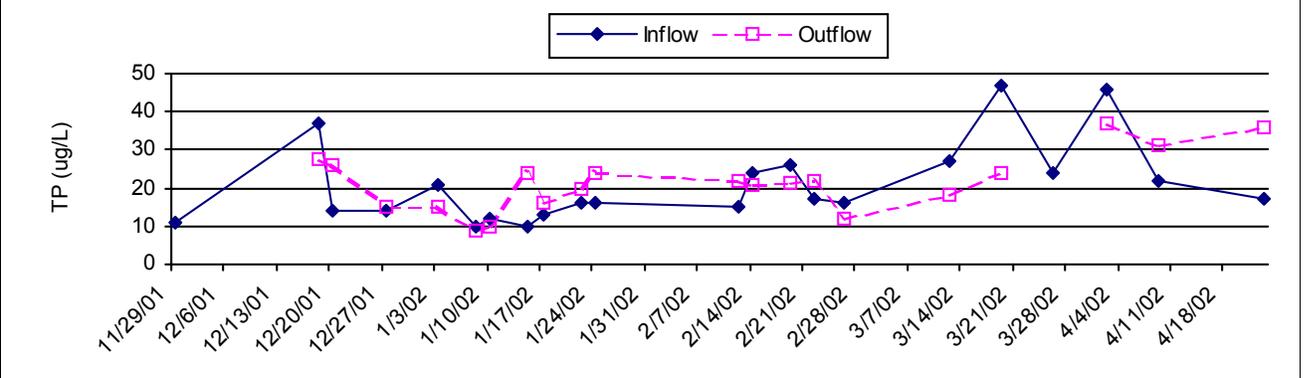
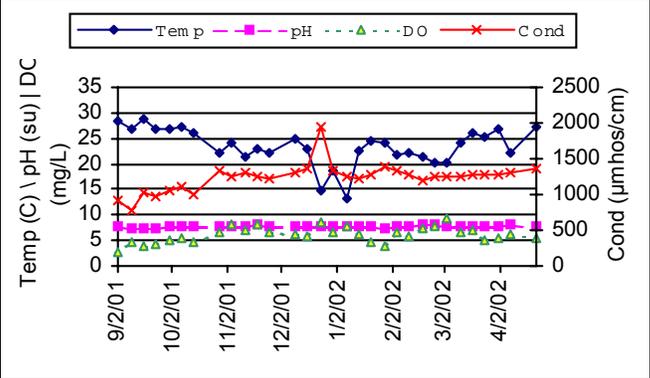
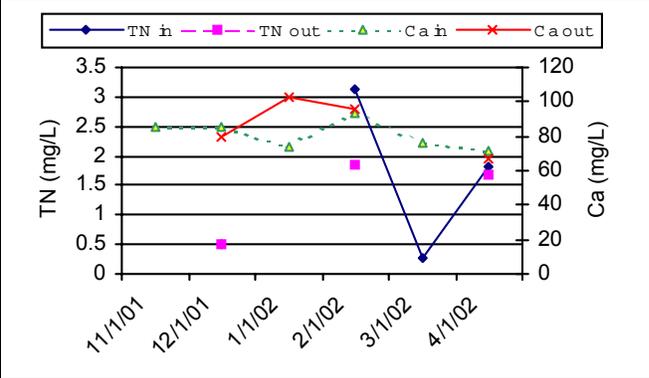
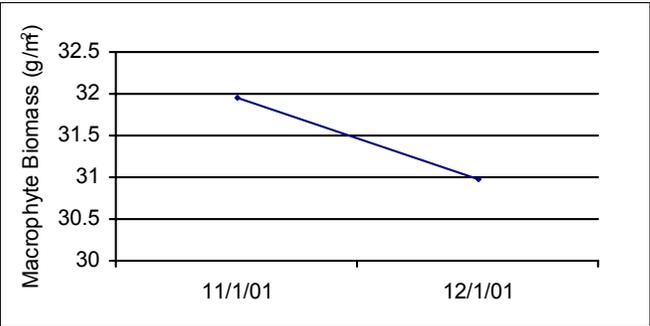
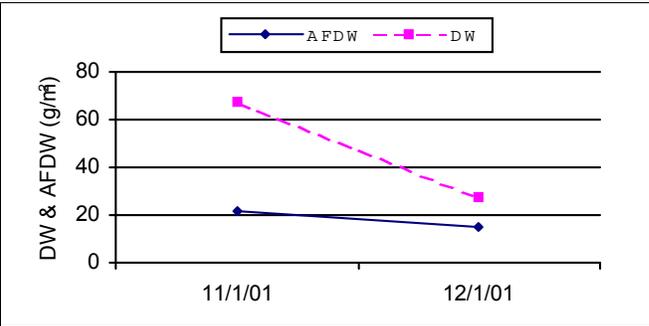
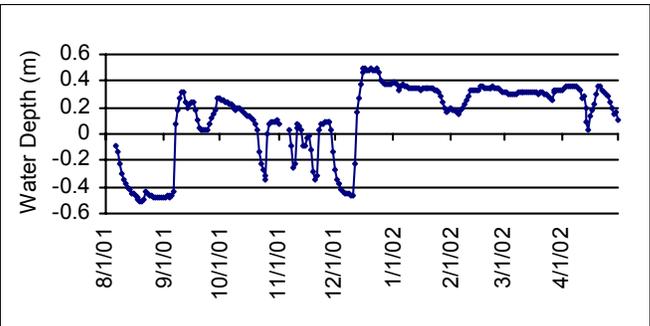
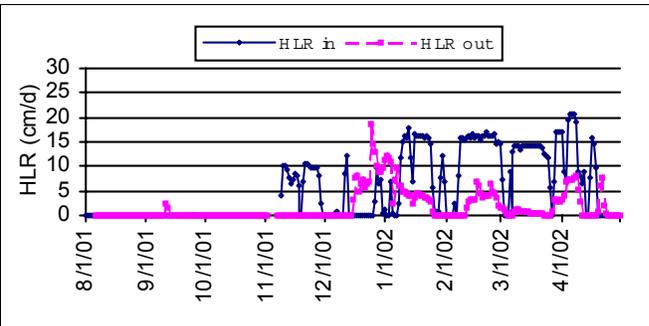


## Summary for Period

Cell	Avg HLR (cm/d)	Depth (m)	TP in (ug/L)	TP out (ug/L)	$k_1$ (m/yr)
FS-3	7.02	0.32	19	15	6.8

# PSTA Research and Demonstration Project Phase 3 Field Scale PSTAs

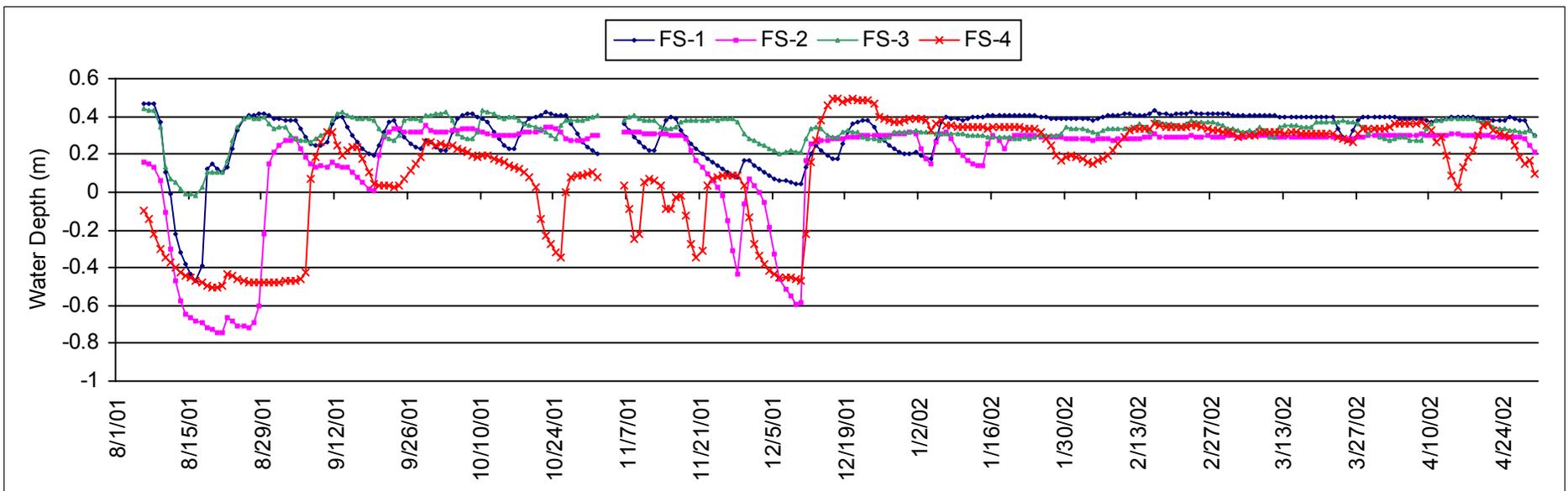
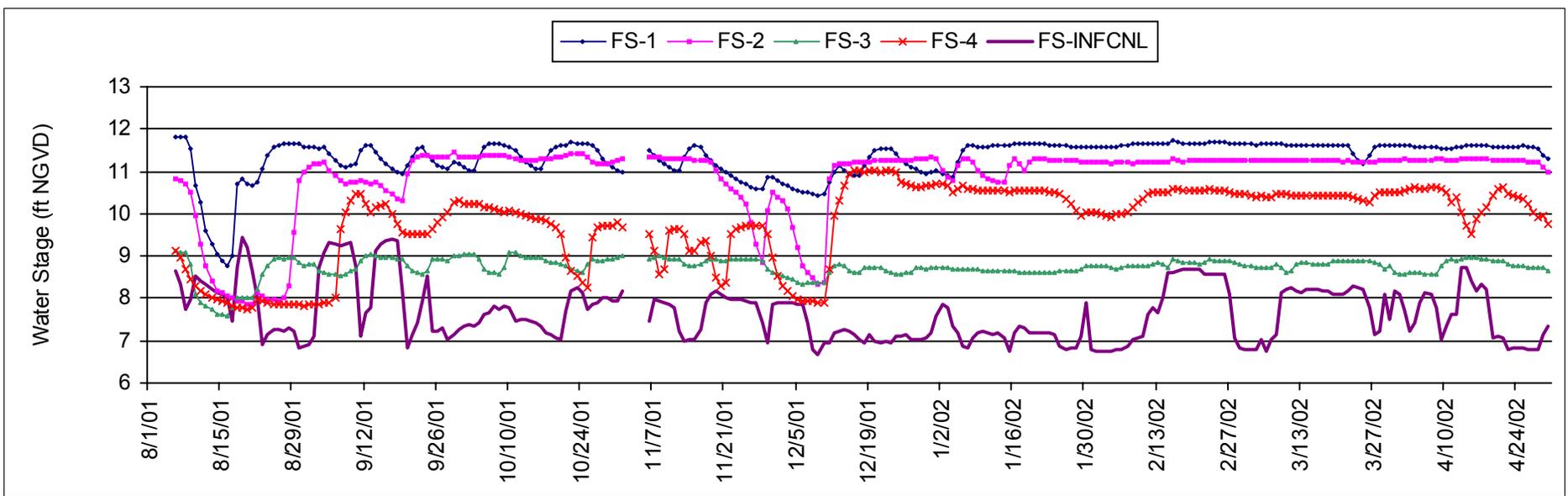
<b>Treatment:</b> FS-4	<b>Period:</b> 8/1/2001 - 6/27/2002
<b>Cell Size:</b> 66 x 315 m (2.08 ha)	<b>Soil:</b> Peat



### Summary for Period

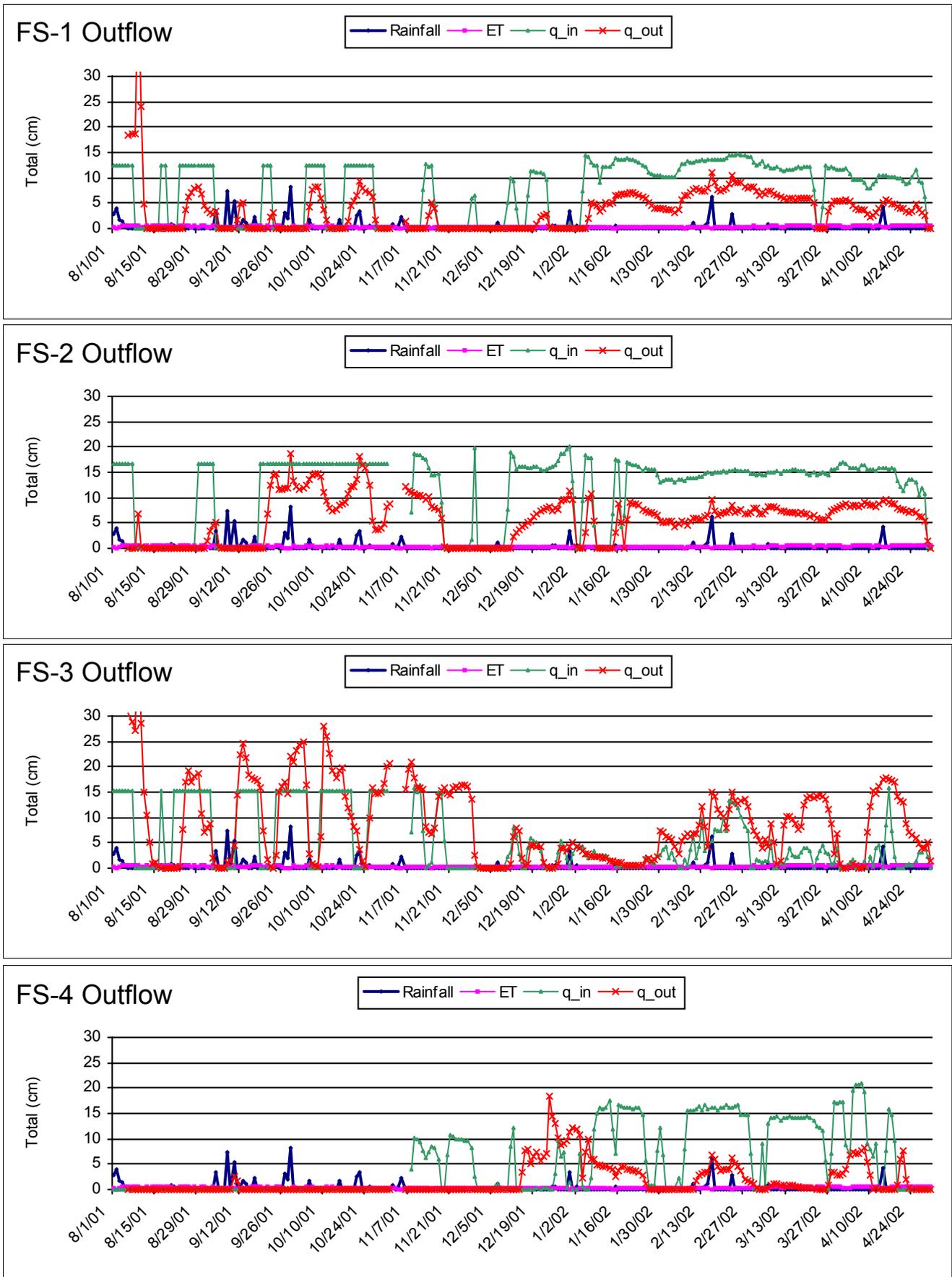
Cell	Avg HLR (cm/d)	Depth (m)	TP in (ug/L)	TP out (ug/L)	$k_1$ (m/yr)
FS-4	3.54	0.12	21	22	-0.5

### PSTA Field Scale Phase 3 Water Stage and Depths

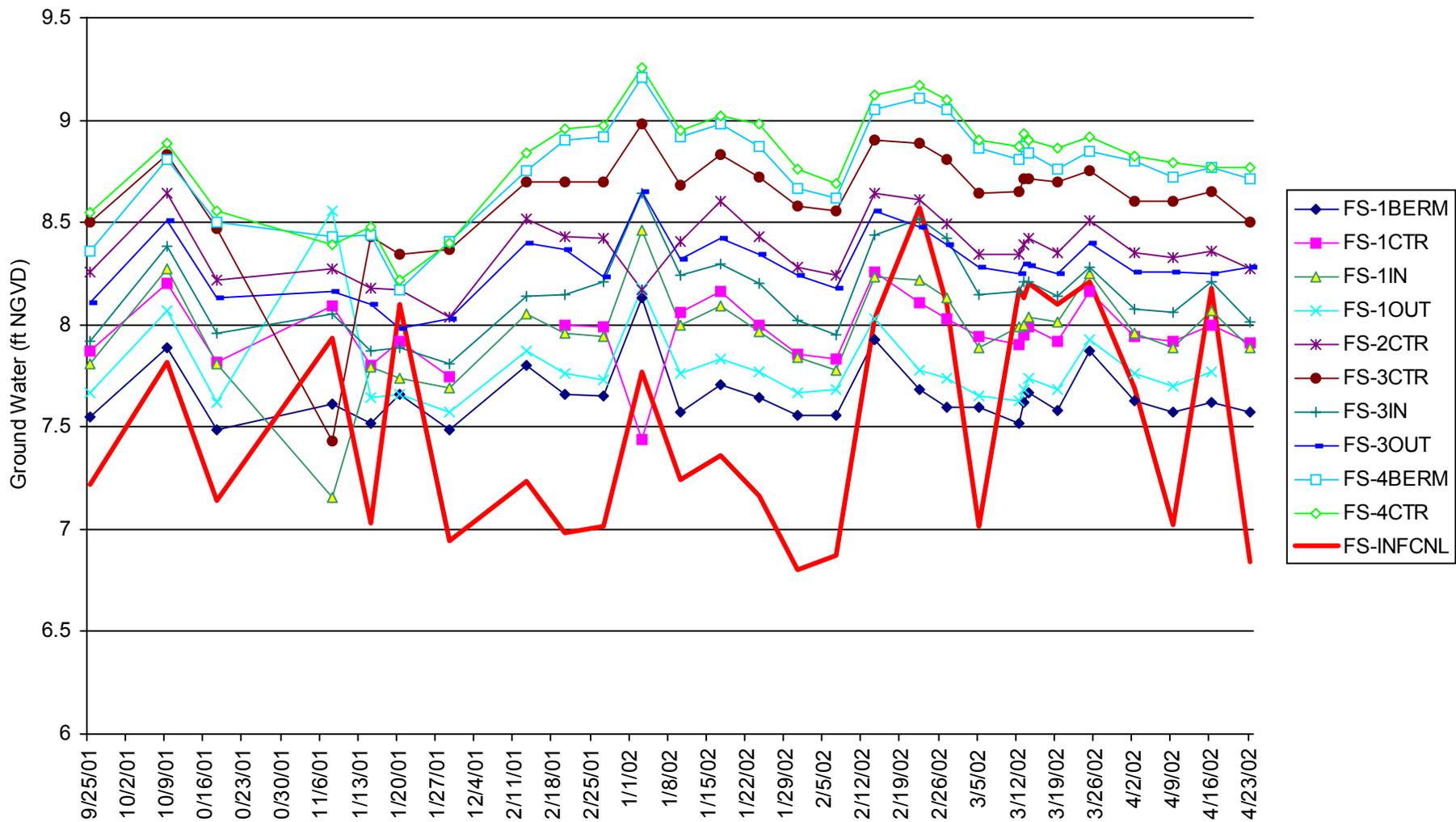


# PSTA Field Scale Phase 3

## Rainfall, Evapotranspiration, and Hydraulic Loading

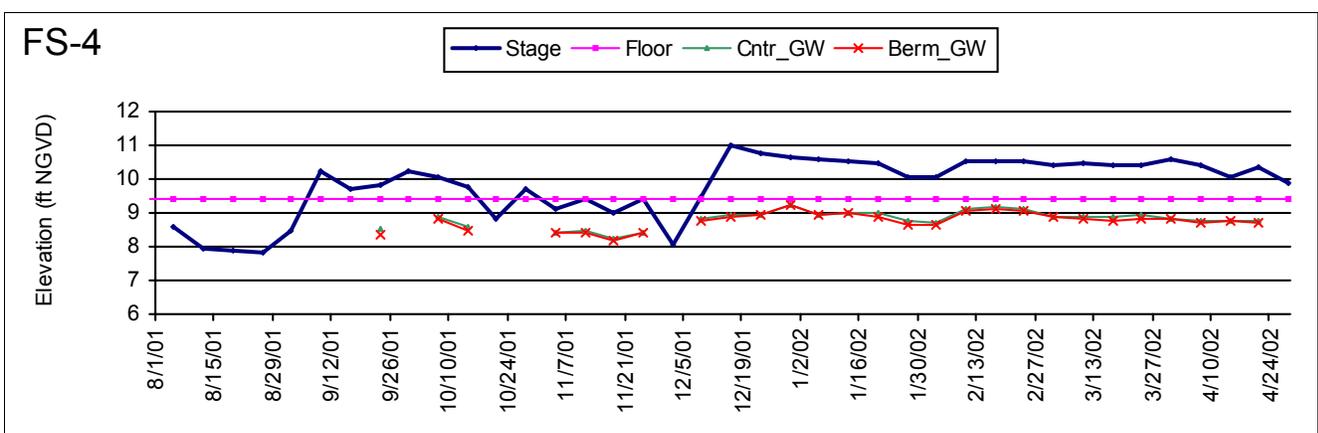
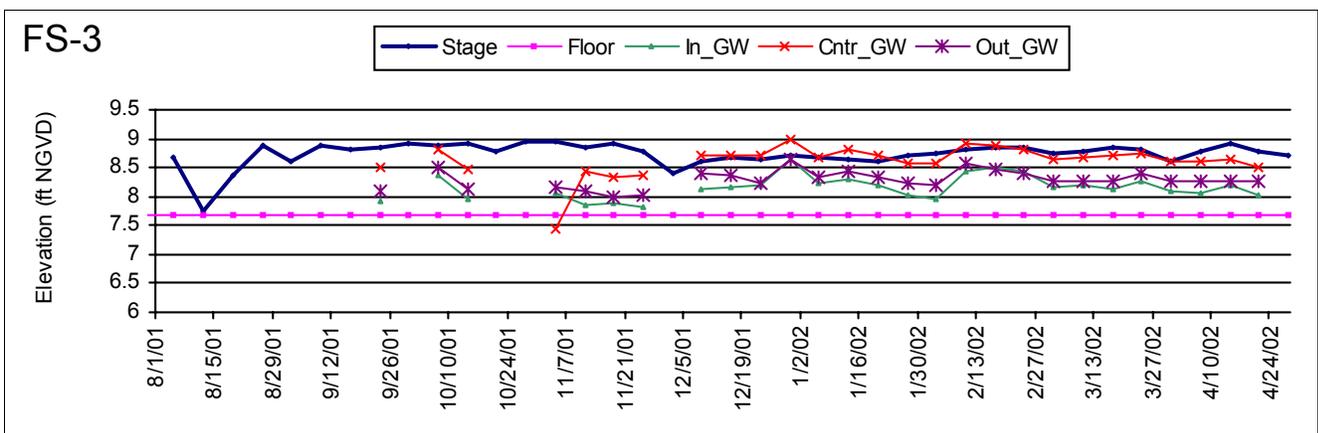
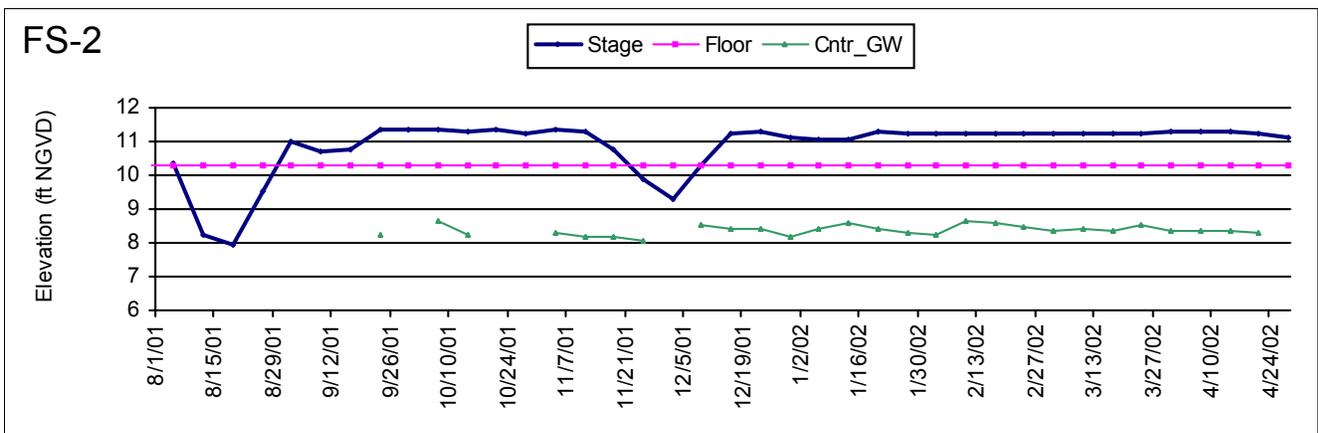
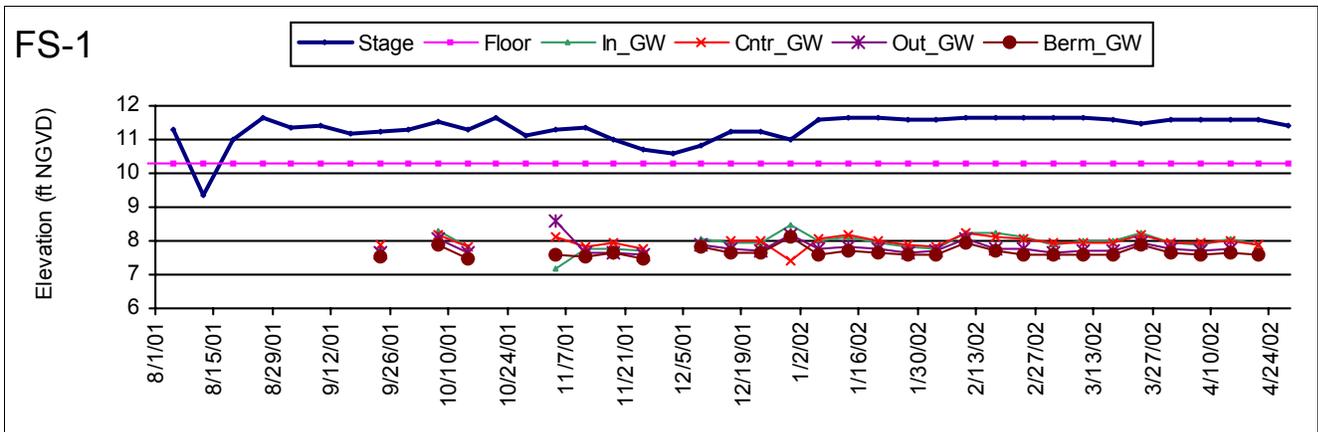


### PSTA Field Scale Phase 3 Ground Water Elevations

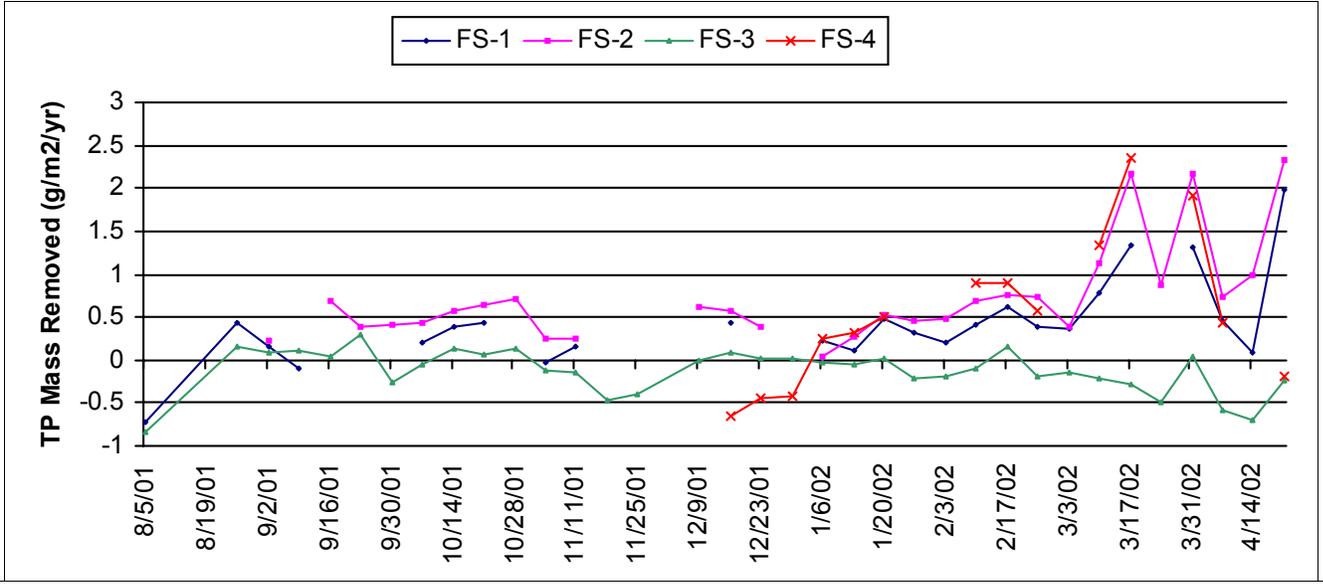
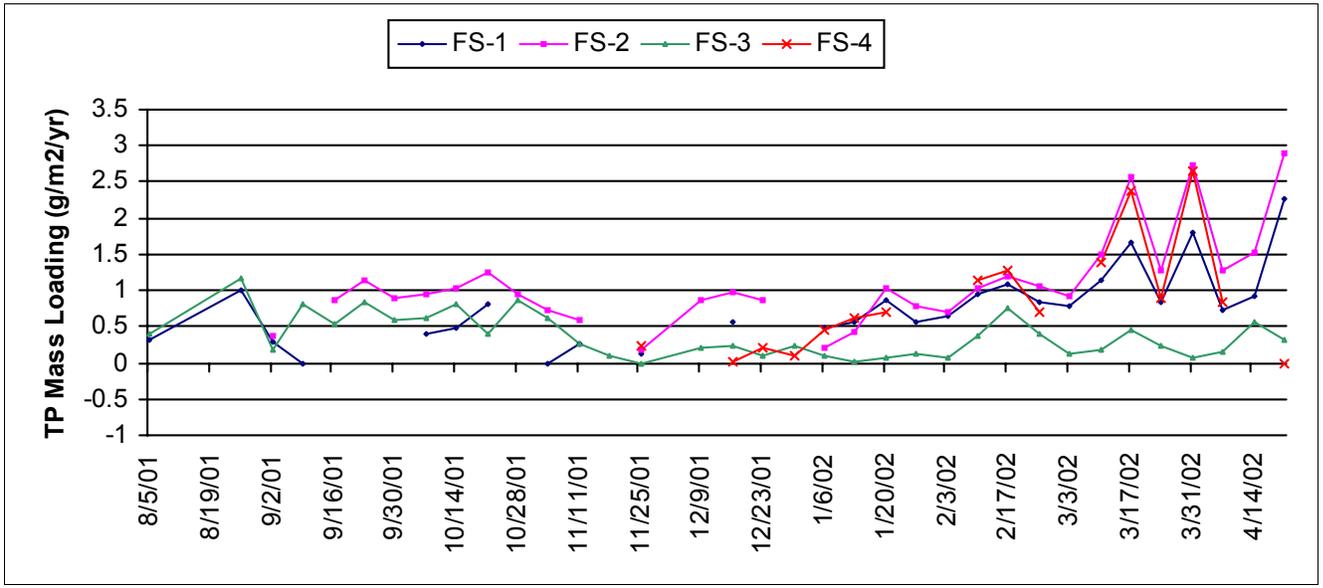
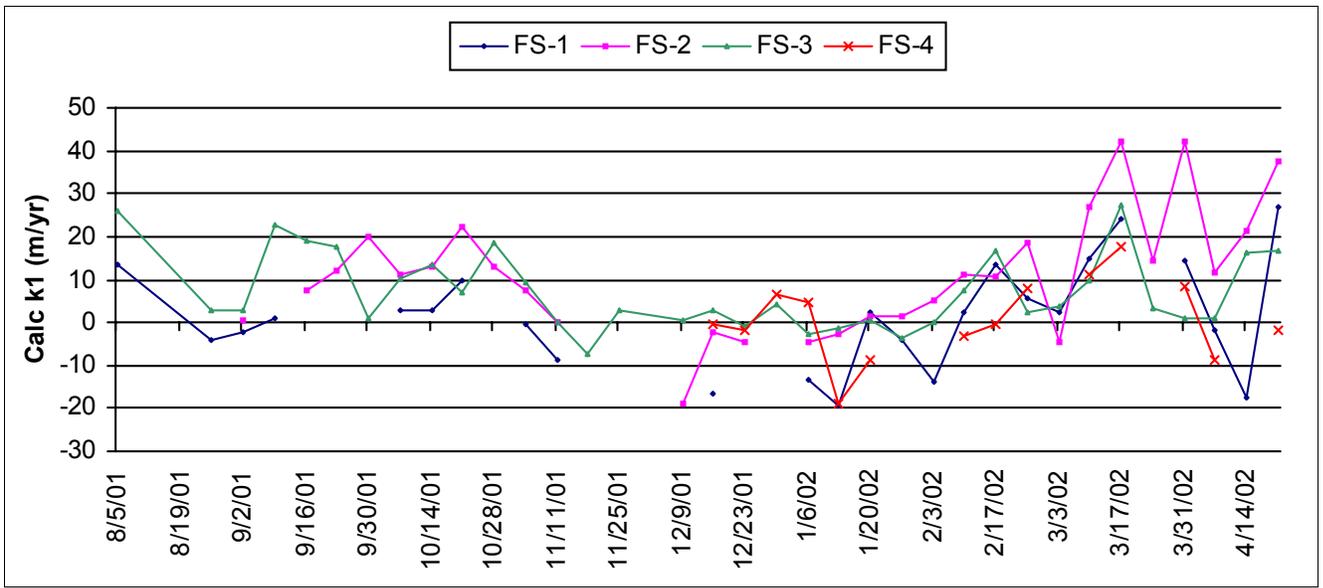


FS-INFCNL = Inflow Canal Stage

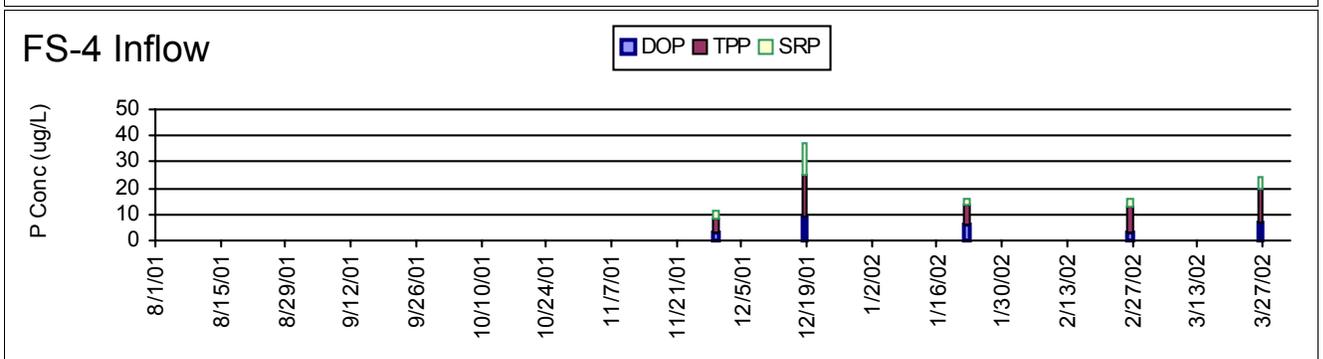
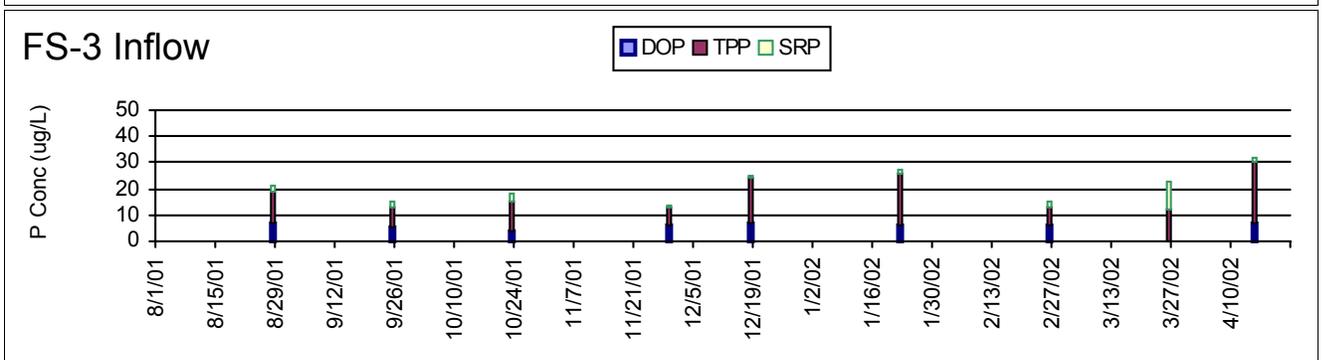
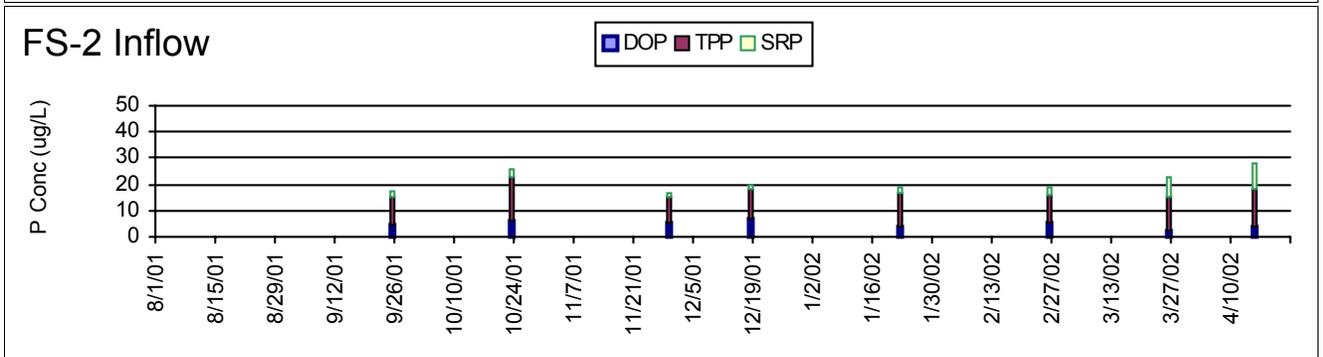
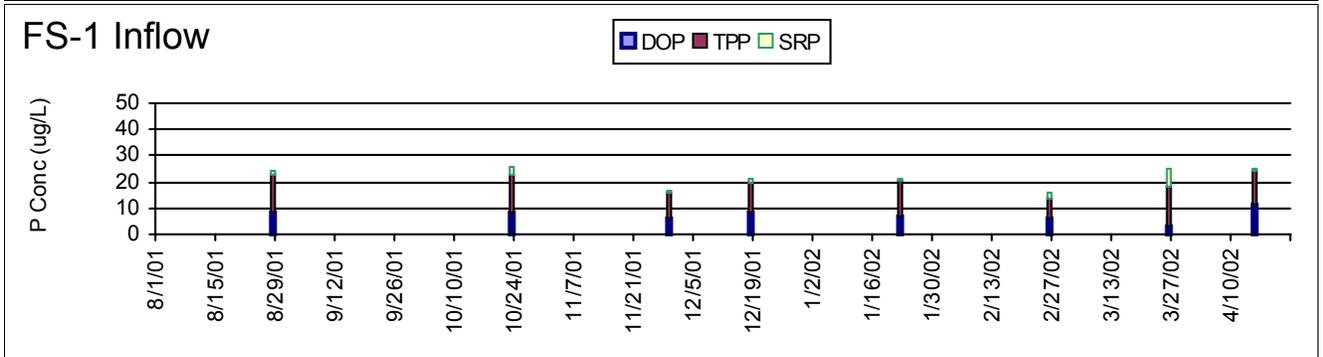
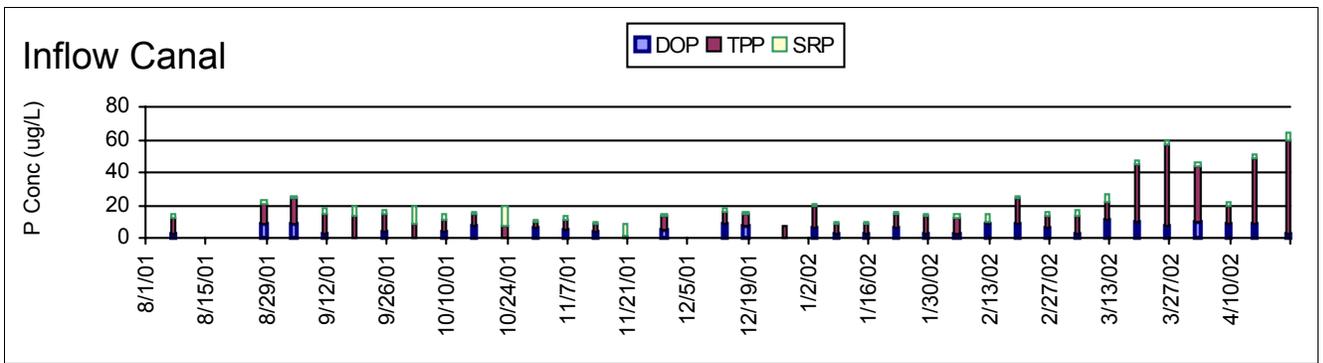
## PSTA Field Scale Phase 3 Water Stage and Groundwater Elevations



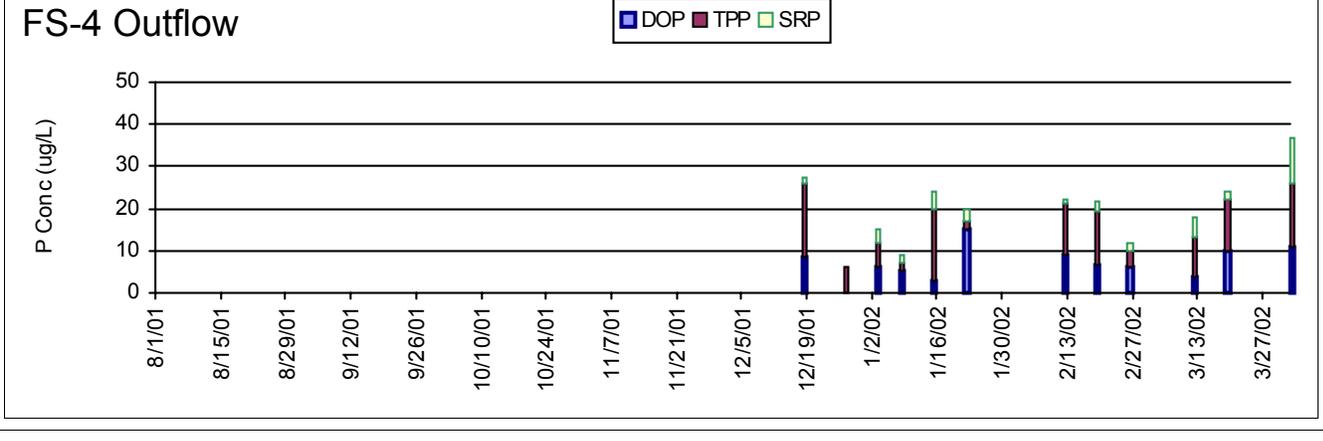
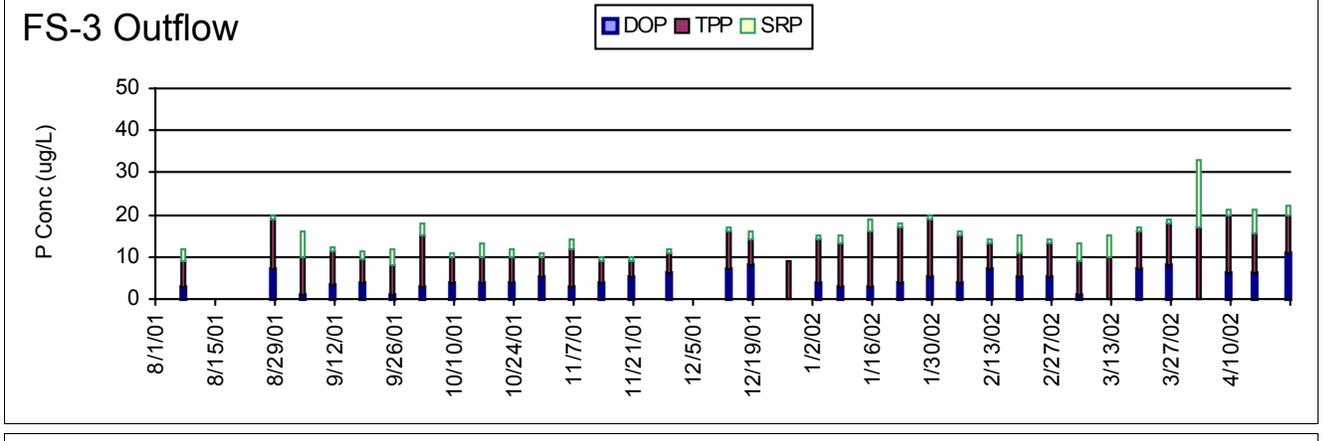
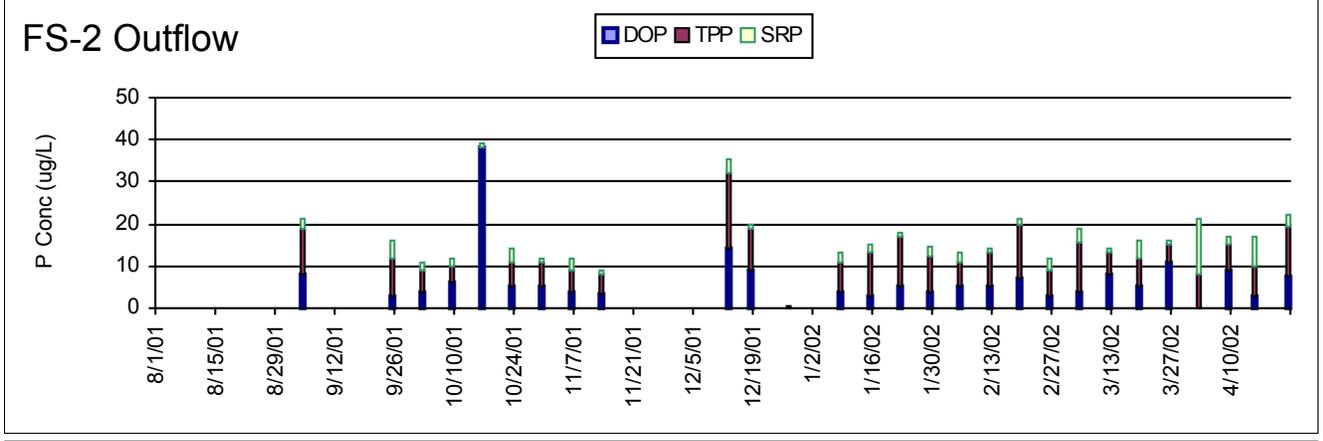
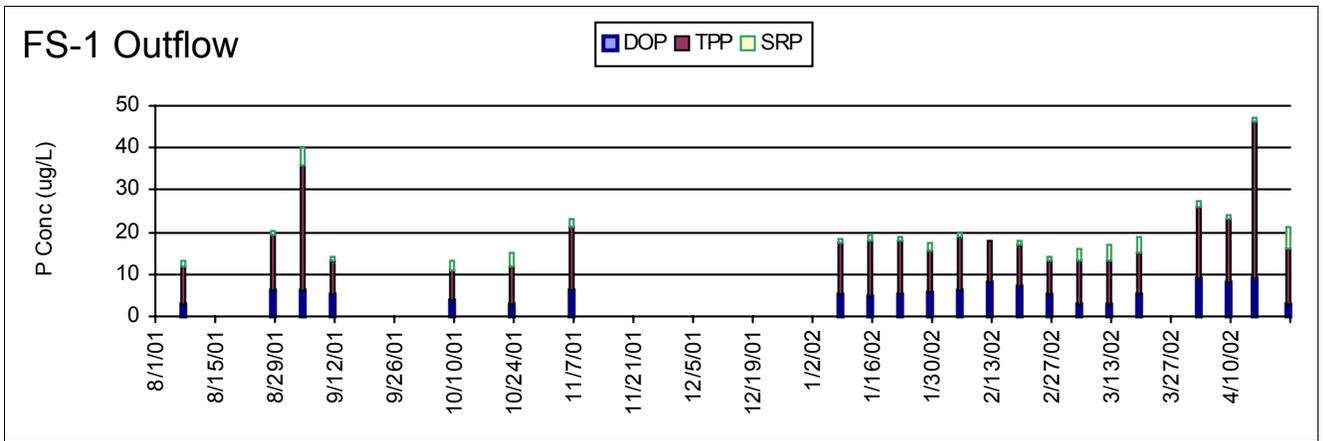
## PSTA Field Scale Phase 3 Phosphorus Mass Loading and Removal



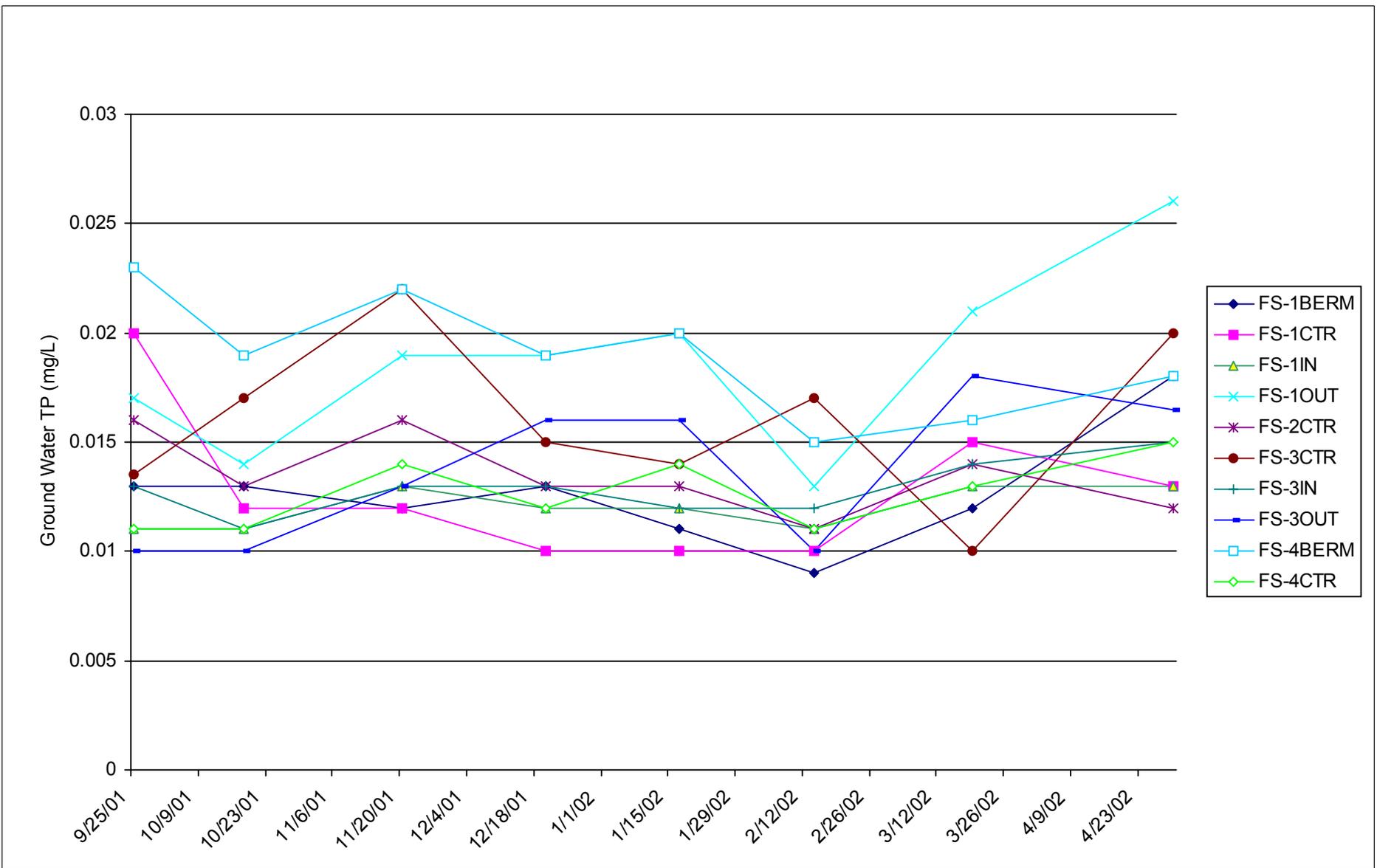
## PSTA Field Scale Phase 3 Surface Water Inflow Phosphorus



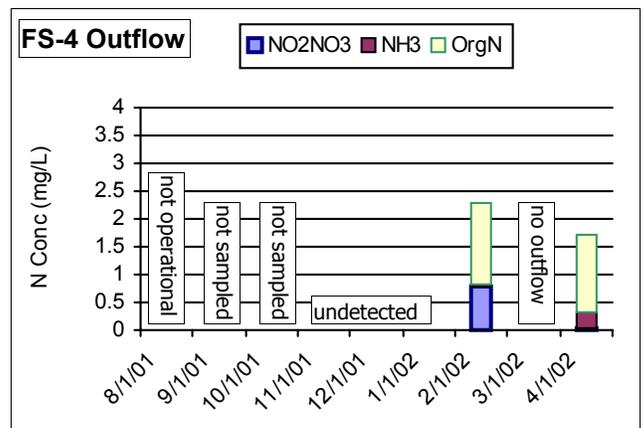
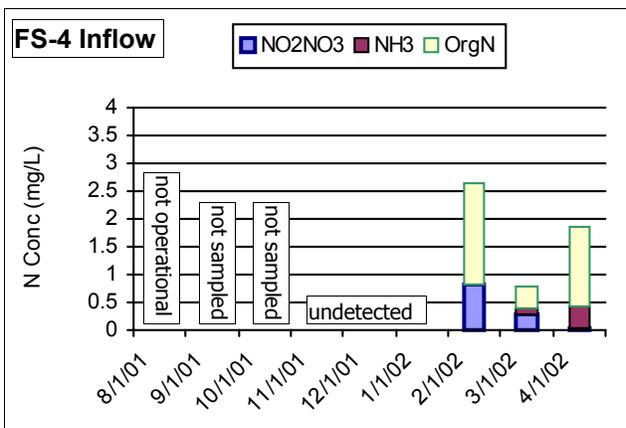
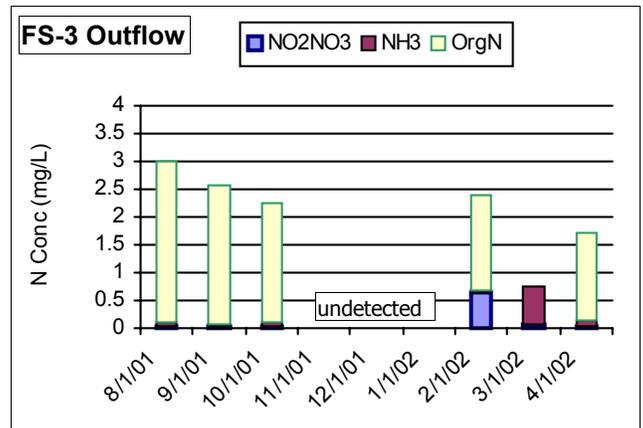
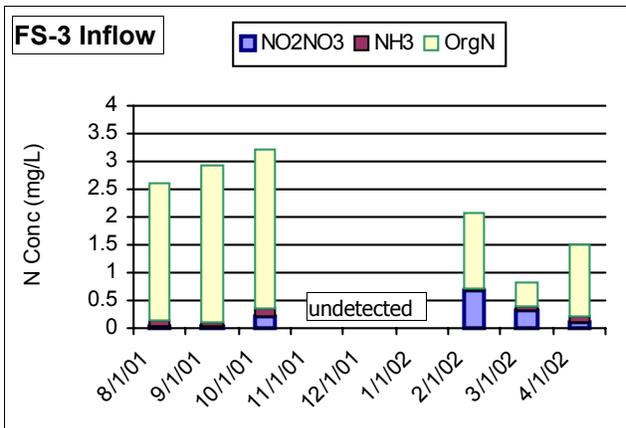
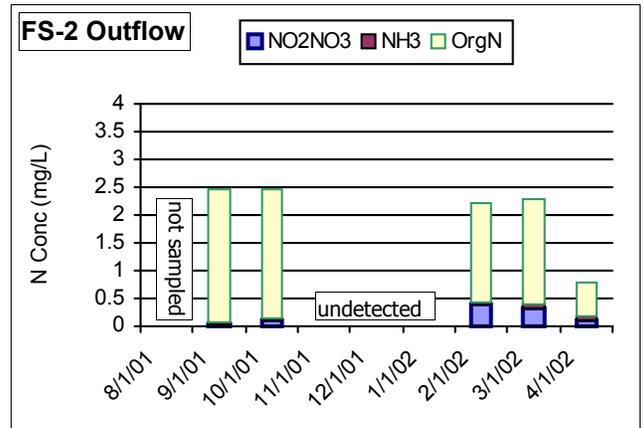
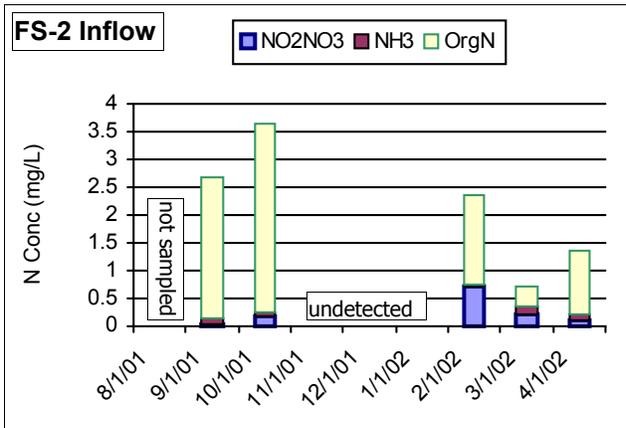
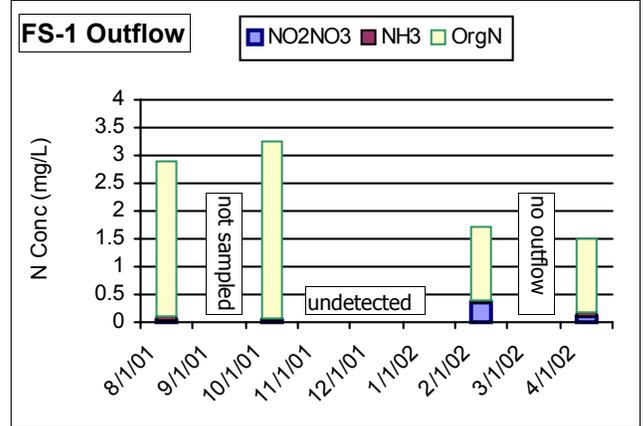
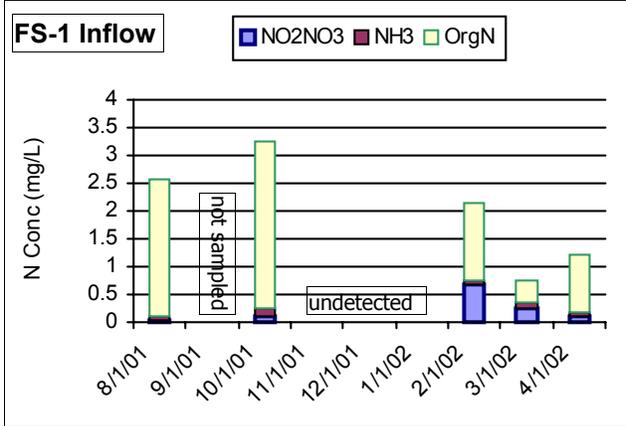
## PSTA Field Scale Phase 3 Surface Water Outflow Phosphorus



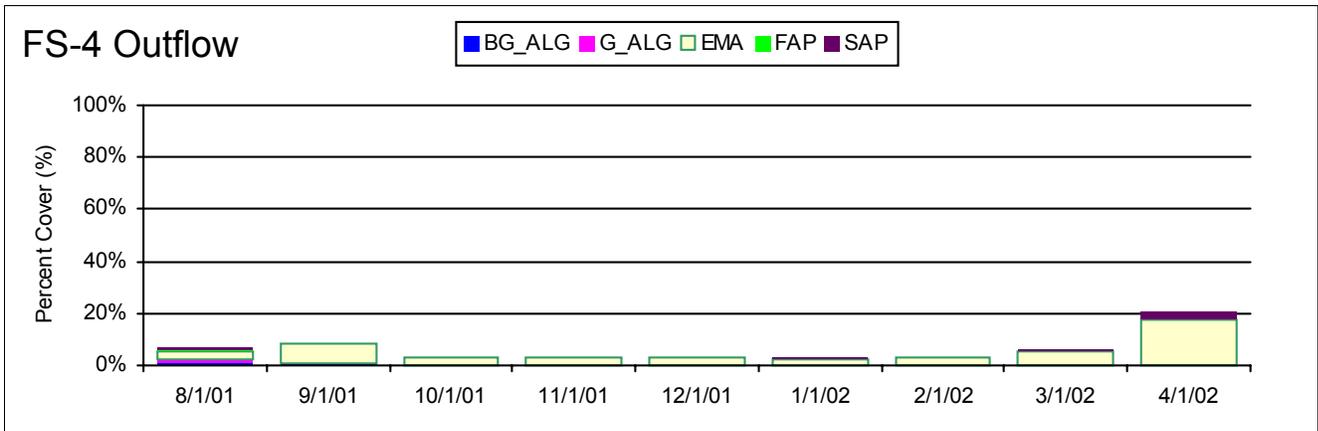
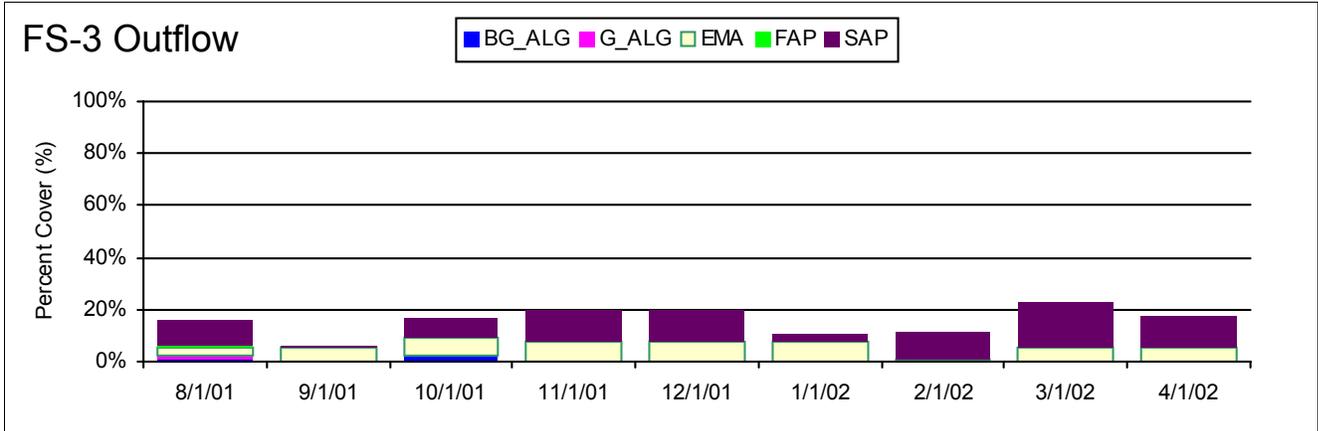
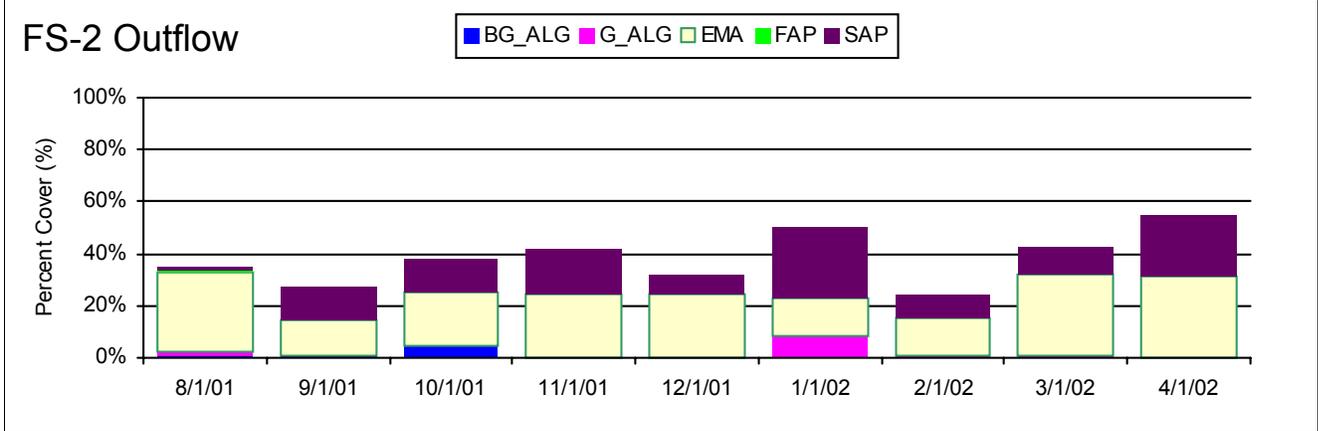
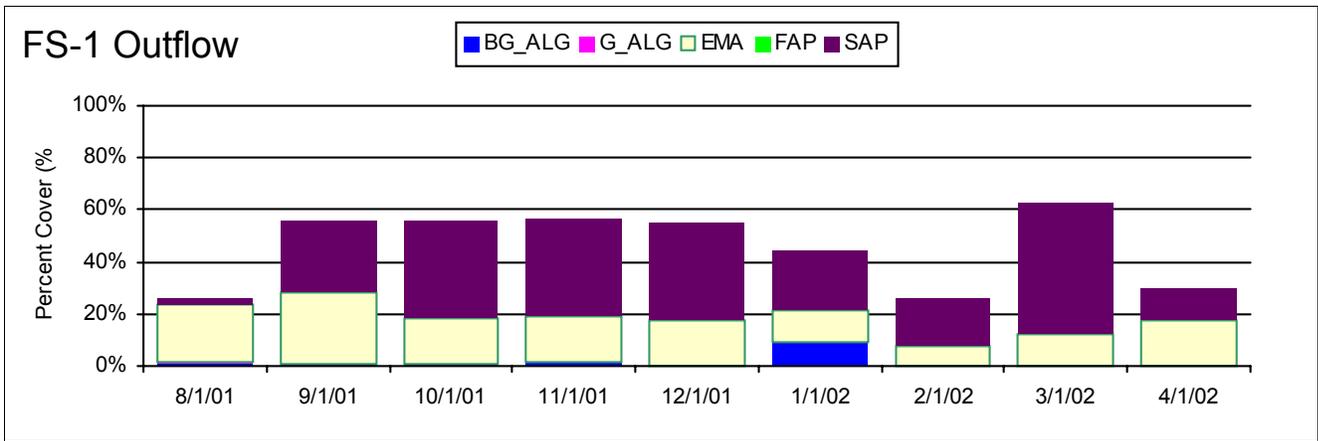
### PSTA Field Scale Phase 3 Ground Water TP Concentrations



## PSTA Field Scale Phase 3 Surface Water Inflow and Outflow Nitrogen



## PSTA Field Scale Phase 3 Estimated Percent Cover



APPENDIX D

Field-Scale PSTA Algal Biovolume Data (cm<sup>3</sup>/m<sup>2</sup>) and Cell Counts (# cells/m<sup>2</sup> x 10<sup>6</sup>)

Date	Organism Code	Division Code	Organism	Biovolume (cm <sup>3</sup> /m <sup>2</sup> )				Cell Counts (# cells/m <sup>2</sup> x 10 <sup>6</sup> )				
				FSC-1	FSC-2	FSC-3	FSC-4	FSC-1	FSC-2	FSC-3	FSC-4	
Oct-01	APHN FLO	1	APHANIZOMENON FLOS-AQUAE	--	1374	--	--	--	6245	--	--	--
	APHA STA	1	APHANOTHECE STAGNINA	--	959	555	--	--	3997	2315	--	--
	CHR DIS	1	CHROOCOCCUS DISPERSUS	91	--	--	--	647	--	--	--	--
	CHR MINI	1	CHROOCOCCUS MINIMUS	272	480	914	--	6796	11991	22858	--	--
	CHR MIN	1	CHROOCOCCUS MINUTUS	36	--	64	--	324	--	579	--	--
	CHR PRE	1	CHROOCOCCUS PRESCOTTII	4194	--	--	--	2589	--	--	--	--
	CHR TUR	1	CHROOCOCCUS TURGIDUS	867	--	--	--	324	--	--	--	--
	COE PUS	1	COELOMORON PUSILLUM	--	420	--	--	--	6994	--	--	--
	G GLO	1	GLOEOCAPSA SP	--	60	--	--	--	1499	--	--	--
	JAA ANG	1	JAAGINEMA ANGUSTISSIMUM	278	400	694	--	13916	19984	34721	--	--
	LEP LAG	1	LEPTOLYNGBYA LAGERHEIMII	1010	570	--	--	16829	9493	--	--	--
	MER TEN	1	MERISMOPEDIA TENUISSIMA	42	--	--	--	4207	--	--	--	--
	PHO FOR	1	PHORMIDIUM FORMOSUM	11249	--	--	--	14240	--	--	--	--
	PHO WIL	1	PHORMIDIUM WILLEI?	--	--	4253	--	--	--	20254	--	--
	PLA SUB	1	PLANKTOLYNGBYA SUBTILIS	4602	2698	1250	--	25567	14988	6944	--	--
	PSE LIM	1	PSEUDANABAENA LIMNETICA	1699	7257	4051	--	24272	103668	57868	--	--
	PSE MON	1	PSEUDANABAENA MONILIFORMIS	505	390	602	--	3884	2998	4629	--	--
	SCH ARE	1	SCHIZOTHRIX ARENARIA?	--	6495	--	--	--	49961	--	--	--
	G SCY	1	SCYTONEMA SP?	121021	--	--	--	8738	--	--	--	--
	SPI SUB	1	SPIRULINA SUBSALSA	--	157	182	--	--	250	289	--	--
	G SYNE	1	SYNECHOCOCCUS SP	1036	--	4259	--	1618	--	6655	--	--
	ANK NAN	3	ANKISTRODESMUS NANNOSELENE	--	10	--	--	--	250	--	--	--
	ANK SPI	3	ANKISTRODESMUS SPIRALIS	19	--	--	--	162	--	--	--	--
	G CHLA	3	CHLAMYDOMONAS SP	434	--	--	--	162	--	--	--	--
	DIC PUL	3	DICTYOSPHAERIUM PULCHELLUM	--	--	162	--	--	--	1157	--	--
	OOC SOL	3	OOCYSTIS SOLITARIA	2196	--	--	--	162	--	--	--	--
	SCE BIJ	3	SCENEDESMUS BIJUGA	32	100	87	--	324	999	868	--	--
	SCE BIJ AL	3	SCENEDESMUS BIJUGA V ALTERNANS	207	--	--	--	647	--	--	--	--
	SCE DEN	3	SCENEDESMUS DENTICULATUS	--	--	1198	--	--	--	579	--	--
	SCE QUA	3	SCENEDESMUS QUADRICAUDA	--	510	--	--	--	500	--	--	--
	G SPI	3	SPIROGYRA SP	--	499905	--	--	--	500	--	--	--
	TET MIN	3	TETRAEDRON MINIMUM	--	--	133	--	--	--	289	--	--
	TET TRI	3	TETRAEDRON TRIGONUM	--	2431	--	--	--	250	--	--	--
	ACHN MIN	4	ACHNANTHIDIUM MINUTISSIMUM	227	350	405	--	162	250	289	--	--
	BRA VIT	4	BRACHYSIRA VITREA	--	12585	7951	--	--	2748	1736	--	--
	CYM MIC	4	CYMBELLA MICROCEPHALA	--	1699	492	--	--	999	289	--	--
	DIP OBL	4	DIPLONEIS OBLONGELLA	--	--	972	--	--	--	289	--	--
	DIP OVA	4	DIPLONEIS OVALIS	652	1007	--	--	162	250	--	--	--
	ENC EVE	4	ENCYONEMA EVERGLADIANUM	608	1879	2176	--	324	999	1157	--	--
	FRA SYN	4	FRAGILARIA SYNEGROTESCA	--	5356	--	--	--	500	--	--	--
	GOM PAR	4	GOMPHONEMA PARVULUM	2890	8923	--	--	162	500	--	--	--
	MAS SMI LA	4	MASTOGLOIA SMITHII V LACUSTRIS	--	4017	4653	--	--	250	289	--	--
	NAV CRY	4	NAVICULA CRYPTOCEPHALA	686	3177	--	--	162	749	--	--	--
	NAV CRYP	4	NAVICULA CRYPTOTENELLA	--	1854	--	--	--	250	--	--	--
NAV POD	4	NAVICULA PODZORSKII	--	5508	--	--	--	250	--	--	--	
NIT PAL	4	NITZSCHIA PALEA	850	--	--	--	162	--	--	--	--	
NIT PALE	4	NITZSCHIA PALEACEA	--	157	--	--	--	250	--	--	--	
NIT PALF	4	NITZSCHIA PALEAFORMIS	2764	10667	--	--	324	1249	--	--	--	
NIT SEM	4	NITZSCHIA SEMIROBUSTA	1903	2938	1701	--	324	500	289	--	--	
G NIT SM	4	NITZSCHIA SP (SMALL)	172	1324	307	--	162	1249	289	--	--	
Jan-02	ANA AFF	1	ANABAENA AFFINIS	290	147	--	--	580	294	--	--	--
	APHN FLO	1	APHANIZOMENON FLOS-AQUAE	77	--	432	--	348	--	1963	--	--
	APH CON	1	APHANOCAPSA CONFERTA	155	--	--	--	3868	--	--	--	--
	APH DEL	1	APHANOCAPSA DELICATISSIMA	--	--	--	2	--	--	--	192	--
	APH HOL	1	APHANOCAPSA HOLSATICA	56	--	--	8	1393	--	--	208	--
	APH INC	1	APHANOCAPSA INCERTA	24	--	--	--	2398	--	--	--	--
	APHA CLA	1	APHANOTHECE CLATHRATA	--	--	--	7	--	--	--	232	--
	APHA SMI	1	APHANOTHECE SMITHII	--	--	--	4	--	--	--	64	--
	APHA STA	1	APHANOTHECE STAGNINA	--	705	388	21	--	2939	1616	88	--
	CHR MINI	1	CHROOCOCCUS MINIMUS	31	75	18	2	774	1881	462	48	--
	CHR MIN	1	CHROOCOCCUS MINUTUS	8	--	13	1	77	--	115	8	--
	CHR PRE	1	CHROOCOCCUS PRESCOTTII	--	--	374	--	--	--	231	--	--
	G GLO	1	GLOEOCAPSA SP	--	14	5	1	--	353	115	24	--
	JAA ANG	1	JAAGINEMA ANGUSTISSIMUM	23	--	95	1	1161	--	4734	48	--
	LEI EPI	1	LEIBLEINIA EPIPHYTICA	46	--	--	--	774	--	--	--	--
	LEP LAG	1	LEPTOLYNGBYA LAGERHEIMII	--	--	139	--	--	--	2309	--	--
	LIM AMP	1	LIMNOTHRIX AMPHIGRANULATA	80	--	--	--	503	--	--	--	--
	MER DUP	1	MERISMOPEDIA DUPLEX	--	--	355	--	--	--	2367	--	--
	MER GLA	1	MERISMOPEDIA GLAUCA	87	198	170	4	619	1411	1212	32	--
	MER TEN	1	MERISMOPEDIA TENUISSIMA	13	16	22	1	1315	1646	2194	64	--
	PHO AER	1	PHORMIDIUM AERUGINEO-CAERULEUM	2100	--	--	--	1780	--	--	--	--
	PHO FOR	1	PHORMIDIUM FORMOSUM	1222	1486	--	--	1547	1881	--	--	--
	G PHO	1	PHORMIDIUM SP	--	--	866	--	--	--	3464	--	--
	PHO WIL	1	PHORMIDIUM WILLEI?	--	--	703	--	--	--	3348	--	--
	PLA SUB	1	PLANKTOLYNGBYA SUBTILIS	397	127	748	79	2205	705	4156	437	--

## APPENDIX D

Field-Scale PSTA Algal Biovolume Data (cm<sup>3</sup>/m<sup>2</sup>) and Cell Counts (# cells/m<sup>2</sup> x 10<sup>6</sup>)

Date	Organism Code	Division Code	Organism	Biovolume (cm <sup>3</sup> /m <sup>2</sup> )				Cell Counts (# cells/m <sup>2</sup> x 10 <sup>6</sup> )			
				FSC-1	FSC-2	FSC-3	FSC-4	FSC-1	FSC-2	FSC-3	FSC-4
	PSE LIM	1	PSEUDANABAENA LIMNETICA	598	62	848	19	8549	882	12123	276
	PSE MON	1	PSEUDANABAENA MONILIFORMIS	146	367	--	26	1122	2821	--	200
	PSE PAP	1	PSEUDANABAENA PAPILLATERMINATA?	374	--	1709	--	1780	--	8139	--
	G SCY	1	SCYTONEMA SP?	--	22792	--	--	--	1646	--	--
	SNO LAC	1	SNOWELLA LACUSTRIS	--	--	--	32	--	--	--	128
	SPI SUB	1	SPIRULINA SUBSALSA	--	37	--	--	--	59	--	--
	G SYNE	1	SYNECHOCOCCUS SP	4803	1016	11416	26	7505	1587	17838	40
	ANK FAL	3	ANKISTRODESMUS FALCATUS	80	31	--	--	155	59	--	--
	ANK NAN	3	ANKISTRODESMUS NANNOSELENE	1	--	--	0	39	--	--	4
	ANK SPI	3	ANKISTRODESMUS SPIRALIS	--	--	7	--	--	--	58	--
	G CHLA	3	CHLAMYDOMONAS SP	104	--	--	--	39	--	--	--
	COE MIC	3	COELASTRUM MICROPORUM	--	1375	--	--	--	2116	--	--
	COS BOT	3	COSMARIUM BOTRYTIS	10257	--	--	--	39	--	--	--
	COS VEN EX	3	COSMARIUM VENUSTUM V EXCAVATUM	--	1737	--	--	--	59	--	--
	G DES	3	DESMIDIUM SP	--	9521	--	--	--	176	--	--
	KIR LUN	3	KIRCHNERIELLA LUNARIS	10	--	--	--	77	--	--	--
	OOC PAR	3	OOCYSTIS PARVA	19	--	--	--	77	--	--	--
	OOC SOL	3	OOCYSTIS SOLITARIA	525	797	783	54	39	59	58	4
	SCE BIJ	3	SCENEDESMUS BIJUGA	23	47	34	1	232	470	346	16
	SCE BIJ AL	3	SCENEDESMUS BIJUGA V ALTERNANS	--	150	--	--	--	470	--	--
	SCE QUA	3	SCENEDESMUS QUADRICAUDA	--	--	--	16	--	--	--	16
	G SPI	3	SPIROGYRA SP	--	235239	--	--	--	235	--	--
	TET TRI	3	TETRAEDRON TRIGONUM	--	572	562	156	--	59	58	16
	ACHN MIN	4	ACHNANTHIDIUM MINUTISSIMUM	--	82	--	6	--	59	--	4
	AMP LIN	4	AMPHORA LINEOLATA?	6313	--	9420	--	116	--	173	--
	BAC PAX	4	BACILLARIA PAXILLIFER	547	831	--	--	39	59	--	--
	BRA VIT	4	BRACHYSIRA VITREA	--	--	--	202	--	--	--	44
	CYC MEN	4	CYCLOTELLA MENEGHINIANA	--	--	--	43	--	--	--	4
	CYM MIC	4	CYMBELLA MICROCEPHALA	197	499	491	48	116	294	289	28
	DIP OBL	4	DIPLONEIS OBLONGELLA	130	--	194	--	39	--	58	--
	DIP OVA	4	DIPLONEIS OVALIS	156	--	--	32	39	--	--	8
	ENC EVE	4	ENCYONEMA EVERGLADIANUM	--	1215	326	90	--	647	173	48
	ENC MIN	4	ENCYONEMA MINUTUM	68	--	--	--	39	--	--	--
	FRA FAM	4	FRAGILARIA FAMELICA	--	1058	--	--	--	294	--	--
	FRA SYN	4	FRAGILARIA SYNEGROTESCA	--	3150	--	215	--	294	--	20
	GOM GRA	4	GOMPHONEMA GRACILE	--	206	--	14	--	59	--	4
	GOM INT VI	4	GOMPHONEMA INTRICATUM V VIBRIO	845	--	--	--	39	--	--	--
	GOM PAR	4	GOMPHONEMA PARVULUM	--	1049	1031	72	--	59	58	4
	GYR NOD	4	GYROSIGMA NODIFERUM	--	2909	--	--	--	59	--	--
	MAS LANC	4	MASTOGLOIA LANCEOLATA	--	--	3875	--	--	--	58	--
	MAS SMI LA	4	MASTOGLOIA SMITHII V LACUSTRIS	7464	1890	1857	--	464	118	115	--
	NAV CRYP	4	NAVICULA CRYPTOTENELLA	--	--	--	30	--	--	--	4
	NAV RAD PA	4	NAVICULA RADIOSA V PARVA	--	--	545	--	--	--	58	--
	NIT AMP	4	NITZSCHIA AMPHIBIA	--	282	--	--	--	118	--	--
	NIT CON	4	NITZSCHIA CONSTRICTA	234	--	--	--	39	--	--	--
	NIT FRU	4	NITZSCHIA FRUSTULUM	--	--	--	18	--	--	--	8
	NIT GRA	4	NITZSCHIA GRACILIS	--	--	456	--	--	--	58	--
	NIT PAL	4	NITZSCHIA PALEA	--	308	--	--	--	59	--	--
	NIT PALE	4	NITZSCHIA PALEACEA	--	185	109	5	--	294	173	8
	NIT PALF	4	NITZSCHIA PALEAFORMIS	1322	2008	--	68	155	235	--	8
	NIT SEM	4	NITZSCHIA SEMIROBUSTA	227	1728	679	330	39	294	115	56
	NIT SERP	4	NITZSCHIA SERPENTIRAPHE	--	5462	--	--	--	59	--	--
	THA BRA	4	THALASSIOSIRA BRAMAPUTRAE	--	--	--	183	--	--	--	4
Apr-02	ANA AFF	1	ANABAENA AFFINIS	--	288	1110	--	--	577	2219	--
	APHN FLO	1	APHANIZOMENON FLOS-AQUAE	--	1269	488	--	--	5767	2219	--
	APH DEL	1	APHANOCAPSA DELICATISSIMA	3	--	--	--	262	--	--	--
	APH HOL	1	APHANOCAPSA HOLSATICA	106	--	59	--	2642	--	1480	--
	APHA SMI	1	APHANOTHECE SMITHII	6	300	89	--	105	4998	1480	--
	APHA STA	1	APHANOTHECE STAGNINA	69	--	222	--	288	--	925	--
	CHR MINI	1	CHROOCOCCUS MINIMUS	39	154	385	--	968	3844	9617	--
	CHR PRE	1	CHROOCOCCUS PRESCOTTII	--	--	2397	--	--	--	1480	--
	CHR TUR	1	CHROOCOCCUS TURGIDUS	70	--	--	--	26	--	--	--
	G GLO	1	GLOEOCAPSA SP	4	46	30	--	105	1153	740	--
	JAA ANG	1	JAAGINEMA ANGUSTISSIMUM	13	154	--	--	654	7689	--	--
	LEI EPI	1	LEIBLEINIA EPIPHYTICA	--	461	--	--	--	7689	--	--
	LEP LAG	1	LEPTOLYNGBYA LAGERHEIMII	112	946	333	--	1871	15762	5548	--
	LEP PER	1	LEPTOLYNGBYA PERELEGANS?	99	--	--	--	523	--	--	--
	LIM AMP	1	LIMNOTHRIX AMPHIGRANULATA	--	--	59	--	--	--	370	--
	MER DUP	1	MERISMOPEDIA DUPLEX	16	231	111	--	105	1538	740	--
	MER GLA	1	MERISMOPEDIA GLAUCA	33	--	311	--	235	--	2219	--
	MER PUN	1	MERISMOPEDIA PUNCTATA	3	--	--	--	105	--	--	--
	MER TEN	1	MERISMOPEDIA TENUISSIMA	5	8	19	--	471	769	1849	--
	PHO AER	1	PHORMIDIUM AERUGINEO-CAERULEUM	432	10887	--	--	366	9227	--	--
	G PHO	1	PHORMIDIUM SP	--	--	231	--	--	--	925	--
	PLA SUB	1	PLANKTOLYNGBYA SUBTILIS	688	5778	5393	--	3820	32101	29960	--

APPENDIX D

Field-Scale PSTA Algal Biovolume Data (cm<sup>3</sup>/m<sup>2</sup>) and Cell Counts (# cells/m<sup>2</sup> x 10<sup>6</sup>)

Date	Organism Code	Division Code	Organism	Biovolume (cm <sup>3</sup> /m <sup>2</sup> )				Cell Counts (# cells/m <sup>2</sup> x 10 <sup>6</sup> )			
				FSC-1	FSC-2	FSC-3	FSC-4	FSC-1	FSC-2	FSC-3	FSC-4
	PSE LIM	1	PSEUDANABAENA LIMNETICA	97	1211	1139	--	1387	17300	16275	--
	PSE MON	1	PSEUDANABAENA MONILIFORMIS	46	75	2116	--	353	577	16275	--
	PSE PAP	1	PSEUDANABAENA PAPILLATERMINATA?	--	--	699	--	--	--	3329	--
	SPI SUB	1	SPIRULINA SUBSALSA	8	--	--	--	13	--	--	--
	G SYNE	1	SYNECHOCOCCUS SP	1289	2952	2486	--	2015	4613	3884	--
	ANK NAN	3	ANKISTRODESMUS NANNOSELENE	--	8	--	--	--	192	--	--
	ANK SPI	3	ANKISTRODESMUS SPIRALIS	--	23	67	--	--	192	555	--
	COE SPH	3	COELASTRUM SPHAERICUM	--	600	--	--	--	769	--	--
	OOC PAR	3	OOCYSTIS PARVA	3	--	--	--	13	--	--	--
	SCE BIJ	3	SCENEDESMUS BIJUGA	3	115	37	--	26	1153	370	--
	SCE QUA	3	SCENEDESMUS QUADRICAUDA	27	--	--	--	26	--	--	--
	TET TRI	3	TETRAEDRON TRIGONUM	--	1870	--	--	--	192	--	--
	AMP LIN	4	AMPHORA LINEOLATA?	711	20914	10061	--	13	384	185	--
	BRA VIT	4	BRACHYSIRA VITREA	60	880	1694	--	13	192	370	--
	CYC ATO	4	CYCLOTELLA ATOMUS	--	--	261	--	--	--	185	--
	CYM MIC	4	CYMBELLA MICROCEPHALA	--	327	314	--	--	192	185	--
	ENC EVE	4	ENCYONEMA EVERGLADIANUM	--	--	348	--	--	--	185	--
	ENC MIN	4	ENCYONEMA MINUTUM	--	677	--	--	--	384	--	--
	ENC MIN PS	4	ENCYONEMA MINUTUM V PSEUDOGRACILIS	231	--	--	--	13	--	--	--
	FRA FAM	4	FRAGILARIA FAMELICA	--	2768	--	--	--	769	--	--
	FRA SYN	4	FRAGILARIA SYNEGROTESCA	140	2061	--	--	13	192	--	--
	MAS SMI	4	MASTOGLOIA SMITHII	--	13371	--	--	--	384	--	--
	MAS SMI LA	4	MASTOGLOIA SMITHII V LACUSTRIS	421	12364	5948	--	26	769	370	--
	NAV CRYP	4	NAVICULA CRYPTOTENELLA	--	--	1372	--	--	--	185	--
	NIT FRU	4	NITZSCHIA FRUSTULUM	--	433	--	--	--	192	--	--
	NIT PAL	4	NITZSCHIA PALEA	--	1009	--	--	--	192	--	--
	NIT PALE	4	NITZSCHIA PALEACEA	--	363	116	--	--	577	185	--
	NIT PALF	4	NITZSCHIA PALEAFORMIS	335	1642	--	--	39	192	--	--
	NIT SEM	4	NITZSCHIA SEMIROBUSTA	385	6782	3262	--	65	1153	555	--
	G NIT SM	4	NITZSCHIA SP (SMALL)	--	204	--	--	--	192	--	--
	G EUG	10	EUGLENA SP	1684	--	--	--	13	--	--	--
POR	ANA AFF	1	ANABAENA AFFINIS	97	145	370	--	193	290	740	--
	APHN FLO	1	APHANIZOMENON FLOS-AQUAE	26	881	307	--	116	4004	1394	--
	APH CON	1	APHANOCAPSA CONFERTA	52	--	--	--	1289	--	--	--
	APH DEL	1	APHANOCAPSA DELICATISSIMA	1	--	--	2	87	--	--	192
	APH HOL	1	APHANOCAPSA HOLSATICA	54	--	20	8	1345	--	493	208
	APH INC	1	APHANOCAPSA INCERTA	8	--	--	--	799	--	--	--
	APHA CLA	1	APHANOTHECE CLATHRATA	--	--	--	7	--	--	--	232
	APHA SMI	1	APHANOTHECE SMITHII	2	100	30	4	35	1666	493	64
	APHA STA	1	APHANOTHECE STAGNINA	23	555	388	21	96	2312	1619	88
	CHR DIS	1	CHROOCOCCUS DISPERSUS	30	--	--	--	216	--	--	--
	CHR MINI	1	CHROOCOCCUS MINIMUS	114	236	439	2	2846	5905	10979	48
	CHR MIN	1	CHROOCOCCUS MINUTUS	15	--	25	1	134	--	231	8
	CHR PRE	1	CHROOCOCCUS PRESCOTTII	1398	--	924	--	863	--	570	--
	CHR TUR	1	CHROOCOCCUS TURGIDUS	312	--	--	--	117	--	--	--
	COE PUS	1	COELOMORON PUSILLUM	--	140	--	--	--	2331	--	--
	G GLO	1	GLOEOCAPSA SP	1	40	11	1	35	1002	285	24
	JAA ANG	1	JAAGINEMA ANGUSTISSIMUM	105	184	263	1	5244	9224	13151	48
	LEI EPI	1	LEIBLEINIA EPIPHYTICA	15	154	--	--	258	2563	--	--
	LEP LAG	1	LEPTOLYNGBYA LAGERHEIMII	374	505	157	--	6233	8418	2619	--
	LEP PER	1	LEPTOLYNGBYA PERELEGANS?	33	--	--	--	174	--	--	--
	LIM AMP	1	LIMNOTHRIX AMPHIGRANULATA	27	--	20	--	168	--	123	--
	MER DUP	1	MERISMOPEDIA DUPLEX	5	77	155	--	35	513	1036	--
	MER GLA	1	MERISMOPEDIA GLAUCA	40	66	160	4	285	470	1144	32
	MER PUN	1	MERISMOPEDIA PUNCTATA	1	--	--	--	35	--	--	--
	MER TEN	1	MERISMOPEDIA TENUISSIMA	20	8	13	1	1998	805	1348	64
	PHO AER	1	PHORMIDIUM AERUGINEO-CAERULEUM	844	3629	--	--	715	3076	--	--
	PHO FOR	1	PHORMIDIUM FORMOSUM	4157	495	--	--	5262	627	--	--
	G PHO	1	PHORMIDIUM SP	--	--	366	--	--	--	1463	--

APPENDIX D

Field-Scale PSTA Algal Biovolume Data (cm<sup>3</sup>/m<sup>2</sup>) and Cell Counts (# cells/m<sup>2</sup> x 10<sup>6</sup>)

Date	Organism Code	Division Code	Organism	Biovolume (cm <sup>3</sup> /m <sup>2</sup> )				Cell Counts (# cells/m <sup>2</sup> x 10 <sup>6</sup> )				
				FSC-1	FSC-2	FSC-3	FSC-4	FSC-1	FSC-2	FSC-3	FSC-4	
	PHO WIL	1	PHORMIDIUM WILLEI?	--	--	1652	--	--	--	--	7867	--
	PLA SUB	1	PLANKTOLYNGBYA SUBTILIS	1895	2868	2464	79	10531	15931	13687	437	--
	PSE LIM	1	PSEUDANABAENA LIMNETICA	798	2843	2013	19	11403	40617	28755	276	--
	PSE MON	1	PSEUDANABAENA MONILIFORMIS	232	277	906	26	1786	2132	6968	200	--
	PSE PAP	1	PSEUDANABAENA PAPILLATERMINATA?	125	--	803	--	593	--	3823	--	--
	SCH ARE	1	SCHIZOTHRIX ARENARIA?	--	2165	--	--	--	16654	--	--	--
	G SCY	1	SCYTONEMA SP?	40340	7597	--	--	2913	549	--	--	--
	SNO LAC	1	SNOWELLA LACUSTRIS	--	--	--	32	--	--	--	--	128
	SPI SUB	1	SPIRULINA SUBSALSA	3	65	61	--	4	103	96	--	--
	G SYNE	1	SYNECHOCOCCUS SP	2376	1323	6054	26	3713	2067	9459	40	--
	ANK FAL	3	ANKISTRODESMUS FALCATUS	27	10	--	--	52	20	--	--	--
	ANK NAN	3	ANKISTRODESMUS NANNOSELENE	0	6	--	0	13	147	--	4	--
	ANK SPI	3	ANKISTRODESMUS SPIRALIS	6	8	24	--	54	64	204	--	--
	G CHLA	3	CHLAMYDOMONAS SP	179	--	--	--	67	--	--	--	--
	COE MIC	3	COELASTRUM MICROPORUM	--	458	--	--	--	705	--	--	--
	COE SPH	3	COELASTRUM SPHAERICUM	--	200	--	--	--	256	--	--	--
	COS BOT	3	COSMARIUM BOTRYTIS	3419	--	--	--	13	--	--	--	--
	COS VEN EX	3	COSMARIUM VENUSTUM V EXCAVATUM	--	579	--	--	--	20	--	--	--
	G DES	3	DESMIDIUM SP	--	3174	--	--	--	59	--	--	--
	DIC PUL	3	DICTYOSPHAERIUM PULCHELLUM	--	--	54	--	--	--	386	--	--
	KIR LUN	3	KIRCHNERIELLA LUNARIS	3	--	--	--	26	--	--	--	--
	OOC PAR	3	OOCYSTIS PARVA	8	--	--	--	30	--	--	--	--
	OOC SOL	3	OOCYSTIS SOLITARIA	907	266	261	54	67	20	19	4	--
	SCE BIJ	3	SCENEDESMUS BIJUGA	19	88	53	1	194	874	528	16	--
	SCE BIJ AL	3	SCENEDESMUS BIJUGA V ALTERNANS	69	50	--	--	216	157	--	--	--
	SCE DEN	3	SCENEDESMUS DENTICULATUS	--	--	399	--	--	--	193	--	--
	SCE QUA	3	SCENEDESMUS QUADRICAUDA	9	170	--	16	9	167	--	16	--
	G SPI	3	SPIROGYRA SP	--	245048	--	--	--	245	--	--	--
	TET MIN	3	TETRAEDRON MINIMUM	--	--	44	--	--	--	96	--	--
	TET TRI	3	TETRAEDRON TRIGONUM	--	1624	187	156	--	167	19	16	--
	ACHN MIN	4	ACHNANTHIDIUM MINUTISSIMUM	76	144	135	6	54	103	96	4	--
	AMP LIN	4	AMPHORA LINEOLATA?	2341	6971	6494	--	43	128	119	--	--
	BAC PAX	4	BACILLARIA PAXILLIFER	182	277	--	--	13	20	--	--	--
	BRA VIT	4	BRACHYSIRA VITREA	20	4489	3215	202	4	980	702	44	--
	CYC ATO	4	CYCLOTELLA ATOMUS	--	--	87	--	--	--	62	--	--
	CYC MEN	4	CYCLOTELLA MENEGHINIANA	--	--	--	43	--	--	--	4	--
	CYM MIC	4	CYMBELLA MICROCEPHALA	66	842	432	48	39	495	254	28	--
	DIP OBL	4	DIPLONEIS OBLONGELLA	43	--	389	--	13	--	116	--	--
	DIP OVA	4	DIPLONEIS OVALIS	269	336	--	32	67	83	--	8	--
	ENC EVE	4	ENCYONEMA EVERGLADIANUM	203	1031	950	90	108	549	505	48	--
	ENC MIN	4	ENCYONEMA MINUTUM	23	226	--	--	13	128	--	--	--
	ENC MIN PS	4	ENCYONEMA MINUTUM V PSEUDOGRACILIS	77	--	--	--	4	--	--	--	--
	FRA FAM	4	FRAGILARIA FAMELICA	--	1275	--	--	--	354	--	--	--
	FRA SYN	4	FRAGILARIA SYNEGROTESCA	47	3522	--	215	4	329	--	20	--
	GOM GRA	4	GOMPHONEMA GRACILE	--	69	--	14	--	20	--	4	--
	GOM INT VI	4	GOMPHONEMA INTRICATUM V VIBRIO	282	--	--	--	13	--	--	--	--
	GOM PAR	4	GOMPHONEMA PARVULUM	963	3324	344	72	54	186	19	4	--
	GYR NOD	4	GYROSIGMA NODIFERUM	--	970	--	--	--	20	--	--	--
	MAS LANC	4	MASTOGLOIA LANCEOLATA	--	--	1292	--	--	--	19	--	--
	MAS SMI	4	MASTOGLOIA SMITHII	--	4457	--	--	--	128	--	--	--
	MAS SMI LA	4	MASTOGLOIA SMITHII V LACUSTRIS	2628	6090	4152	--	163	379	258	--	--
	NAV CRY	4	NAVICULA CRYPTOCEPHALA	229	1059	--	--	54	250	--	--	--
	NAV CRYP	4	NAVICULA CRYPTOTENELLA	--	618	457	30	--	83	62	4	--
	NAV POD	4	NAVICULA PODZORSKII	--	1836	--	--	--	83	--	--	--
	NAV RAD PA	4	NAVICULA RADIOSA V PARVA	--	--	182	--	--	--	19	--	--
	NIT AMP	4	NITZSCHIA AMPHIBIA	--	94	--	--	--	39	--	--	--
	NIT CON	4	NITZSCHIA CONSTRICTA	78	--	--	--	13	--	--	--	--
	NIT FRU	4	NITZSCHIA FRUSTULUM	--	144	--	18	--	64	--	8	--
	NIT GRA	4	NITZSCHIA GRACILIS	--	--	152	--	--	--	19	--	--
	NIT PAL	4	NITZSCHIA PALEA	283	439	--	--	54	84	--	--	--
	NIT PALE	4	NITZSCHIA PALEACEA	--	235	75	5	--	373	119	8	--
	NIT PALF	4	NITZSCHIA PALEAFORMIS	1474	4772	--	68	173	559	--	8	--
	NIT SEM	4	NITZSCHIA SEMIROBUSTA	838	3816	1881	330	143	649	320	56	--
	NIT SERP	4	NITZSCHIA SERPENTIRAPHE	--	1821	--	--	--	20	--	--	--
	G NIT SM	4	NITZSCHIA SP (SMALL)	57	509	102	--	54	480	96	--	--
	THA BRA	4	THALASSIOSIRA BRAMAPUTRAE	--	--	--	183	--	--	--	4	--
	G EUG	10	EUGLENA SP	561	--	--	--	4	--	--	--	--

Division Code:

- 1 Cyanobacteria (Bluegreens)
- 3 Chlorophyta (Greens)
- 4 Bacillariophyceae (Diatoms)
- 10 Euglenophyta (Euglenoids)